New York State Education Department

# New York State Museum

JOHN M. CLARKE, Director

## THIRD REPORT OF THE DIRECTOR OF THE SCIENCE DIVISION 1906

INCLUDING THE

60th REPORT OF THE STATE MUSEUM

THE

26th REPORT OF THE STATE GEOLOGIST

AND THE

REPORT OF THE STATE PALEONTOLOGIST FOR 1906

*Reprinted from the 60th Annual Report of the New York State Museum*



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STATE OF NEW YORK

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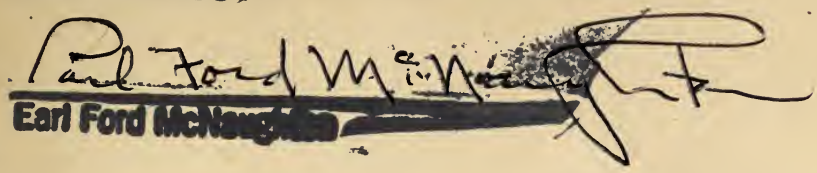


*New York State Education Department*
*Science Division, December 20, 1906*

*Hon. Andrew S. Draper LL.D.*
*Commissioner of Education*

SIR: I have the honor to transmit herewith my Third Annual Report as Director of the Science Division, for publication as the introductory portion of the 60th Annual Report of the State Museum.

Very respectfully
JOHN M. CLARKE
*Director*

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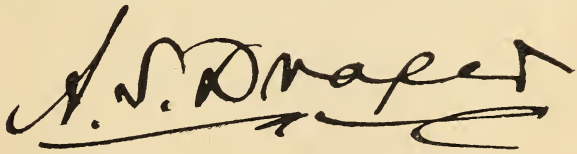
COMMISSIONER'S ROOM

*Approved for publication this 22d day of December* 1906



*Commissioner of Education*

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## THIRD REPORT OF THE DIRECTOR OF THE SCIENCE DIVISION

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## REPORT OF THE DIRECTOR 1906

### INTRODUCTION

This is a report on all the scientific activities under the charge of the Education Department and the Regents of the University, as they have progressed during the fiscal year 1905–6. It constitutes the 60th annual report on the State Museum and is introductory to all the scientific memoirs, bulletins and other publications issued from this office during the year mentioned.

Under the action of the Regents of the University (April 26, 1904) the work of the Science Division is "under the immediate supervision of the Commissioner of Education," and the advisory committee of the Board of Regents of the University having the affairs of this division in charge are the Honorables: T. Guilford Smith LL.D., Buffalo; Daniel Beach LL.D., Watkins; Lucian L. Shedden LL. B., Plattsburg.

The subjects to be presented in this report are considered under the following chapters:

I Condition of the scientific collections

II Report on the Geological Survey, including the work of the State Geologist and Paleontologist, of the Mineralogist and that in Industrial Geology

III Report of the State Botanist

IV Report of the State Entomologist

V Report on the Zoology section

VI Report on the Archeology section

VII Publications of the year

VIII Staff of the Science Division and State Museum

IX Accessions to the collections

X Appendixes: *A* New entries on the general locality record of the paleontological collections; *B* Additions to the catalogue of types of paleozoic fossils

XI Appendixes (to be included in subsequent volumes); all the scientific publications of the year.

## I

## CONDITION OF THE SCIENTIFIC COLLECTIONS CONSTITUTING THE STATE MUSEUM

Each year brings new problems and the efforts at their solution important acquisitions to the collections. The past year, planned for the continued prosecution of work already under way in many lines, has brought to light some extraordinary developments leading to unusual activity both in field and office. These are specially referred to in subsequent chapters. The disposition of the valuable scientific materials accruing therefrom has become a serious problem. In my report of last year reference was made to the incursion upon our collection rooms in the Geological Hall by the Commissioner of Agriculture and his large staff of assistants. The resulting situation, not to be avoided on account of the demands of public business, involved serious curtailment of space available for our use and necessitated the packing away of the entire collection of State minerals and closing to the public the exhibition in economic geology and some part of the collections in ornithology. This cramped and constrained condition applies to all our quarters in every department of our work and only the contemplation of new and ample space, the growing tangible hope of a building adapted to the importance and scope of

our work helps to palliate the existing situation and make our present embarrassments endurable.

The most telling event of the year in this division of the work of the State, that most fraught with gratification for the present and significance for our future development, is the action of the last Legislature in making the preliminary appropriations for a building to embrace and provide for the State Museum and its attendant offices. Our appeals to the Legislature for this end began more than 20 years ago, and for all this long time we have labored under constantly growing disadvantages and embarrassments. The event however obliterates past discomfort and reconciles us to the present condition which must perforce grow still more constrained until the relief arrives.

As a matter of record the present distribution of the scientific collections is here restated.

*A* **Geological Hall.** Here are the offices of the State Botanist with the herbarium, of the State Entomologist with the collections of insects, of the Assistant State Geologist, the Mineralogist and the Zoologist. These office quarters have unavoidably displaced a very considerable part of the collections, as the first two officials named were formerly located in the Capitol and the other offices were on the first floor and in the basement so far as they existed at all. Here are also the workrooms of the Archeologist and Taxidermist. There is an exhibition of zoologic material occupying the fourth or top floor, of rocks and fossils filling such part of the third floor as is not occupied for offices, and all the second floor; the collections in industrial geology and mineralogy and a considerable part of those in ornithology are now stored in the old lecture room. In the basement and cellar are stored in boxes all the collections which have won grand prizes and gold medals at the recent expositions at Buffalo and St Louis.

*B* **State Hall.** The offices of the Director, Geologist and Paleontologist and his staff are in this building, which also contains the most valuable part of the large paleontologic collections of the Museum. These are stored in several thousand drawers and boxes. In the basement is the extensive rock-cutting plant and machine shop. Within recent years three of these offices have been surrendered to the Corporation Tax Bureau and one basement room to the State Engineer.

*C* **Capitol.** The corridors on the fourth floor at the western end and the landing of the western stairway contain a series of cases filled with such part of the archeologic collections as can now

be displayed. Additional specimens pertaining to this collection are displayed in the State Library and many others are packed away for future exhibition.

*D* **Storage house** (McCredie malthouse). In this building are stored many hundreds of boxes and cases of scientific specimens of various kinds, some of which have not been opened in a half century, others containing the materials recently acquired which after being studied have had to be put away.

*E* **Flint Granite Co., Cemetery station.** Here are stored some very large slabs of fossils having a total weight of upwards of 20 tons.

*F* **Property of Joseph L. Verstrepen, north side of Delaware street between Swan and Dove streets, Albany.** Here are stored about 2 tons of slabs bearing fossil sponges from the Chemung group at Bath, N. Y.

It will be entirely evident from the foregoing statements that access to the scientific collections is now practically inhibited. Conditions permit little else than the opening of the material as it comes into the office from the field, unpacking, studying and repacking for storage, to the disadvantage of any one, student or visitor, who may desire to examine such collections.

This situation it is the hope of the present and the realization of the future to remedy.

These existing circumstances have entirely failed to impair the zeal for acquisition or the quality and quantity of accessions to the collections. The annual additions to the State Museum are very large. This year they have been exceptional in quality and volume. For the most part these, irrespective of quality, are for the time being under eclipse in the vaults of the storage house.

## II

## REPORT ON THE GEOLOGICAL SURVEY, INCLUDING THE WORK OF THE STATE GEOLOGIST AND PALEONTOLOGIST, OF THE MINERALOGIST AND THAT ON INDUSTRIAL GEOLOGY

### GEOLOGICAL SURVEY

### Areal geology

The plotting of the rock geology by quadrangles has proceeded as in the previous few years with reasonable celerity and substantial progress.

**Central and western New York.** For the sedimentary rock region of central and western New York the publication of the Buffalo, Penn Yan and Hammondsport sheets has been completed and the Rochester and Ontario Beach sheets, to be issued as one, are printing.

The maps of the Ovid, Genoa and Morrisville quadrangles have been perfected and drawn and the field work has been done on the Geneva, Auburn, Nunda and Portage sheets. Some progress was also made on the Skaneateles and Phelps quadrangles. With the exception of the Morrisville and the Rochester-Ontario Beach maps, this work has been executed by Mr Luther. Farther east Mr Whitnall has completed the Cazenovia sheet which lies between the Morrisville area and the Tully quadrangle which latter was issued two years ago.

The survey of the Syracuse quadrangle has been in charge of Prof. T. C. Hopkins who reports the work completed and the map ready for publication.

With the completion of these quadrangles, added to those already issued in recent years in the adjoining region, the Canandaigua, Naples, Watkins, Elmira, Salamanca and Olean quadrangles, we are able to present in detail the geological structure of an extensive area with an east-west length of 120 miles and reaching from Lake Ontario to the Pennsylvania line. This is a region largely of Devonic rocks developed in their most characteristic and typical American expression, hence we now have the entire thickness of this formation recorded in detail together with the variations east and west of the formational units and the paleontological contents. Included also in this area of close mapping are sections of the Upper Siluric in the Rochester and Syracuse regions and of the Lower Carbonic in the Olean and Salamanca districts.

**Schoharie and Cobleskill valleys.** A very detailed map of this classical region in the Paleozoic rocks of New York has been issued during the past year, prepared by Professor Grabau and published in connection with his bulletin on the *Geology and Paleontology of the Schoharie Valley.*

The history of New York geology may be said to begin with this region and nowhere in the State are the Paleozoic rocks crowded together in so great variety and so characteristic development, nor is any part of the State more inviting to the student of geology, yet until now no adequate map of the region has existed.

**Theresa quadrangle.** I last year reported the progress made by Professor Cushing in the mapping of this region. The region

is one where the early Cambric sediments overlapped the crystallines and have been scraped off therefrom in highly irregular fashion exposing the old rock floor, but leaving the sedimentary Potsdam sandstone in patches and outliers. The mapping here involves somewhat more cautious procedure than is required in the regions previously mentioned where it is known that the outcrops run in approximately east and west lines. The larger part of the Theresa quadrangle is occupied by the Paleozoic rocks but in the northeast portion the Potsdam sandstone is in the process of being stripped away from the underlying crystallines, thus affording opportunity for studying the topography of the ancient rock surface on which the Potsdam sediments were laid down. This old sea floor was of the ridge and valley type, a form derived from erosion before its partial submersion beneath the sea. The ridges trend northeast and have altitudes of 100′ to 200′ above the valleys. The Potsdam sandstone has a maximum thickness of 200′ over the old valleys but on the higher ridges it was never deposited at all.

The Precambric or crystalline rocks are the Granville series, recognized to be of sedimentary origin, and an amphibolite series, the latter badly cut into by a granite batholite.

The Granville sediments disclose two main groups, a thick and pure limestone formation and a formation of thinner beds consisting of sedimentary gneisses, quartzites and limestone. All are repeatedly cut by dikes of igneous rocks chiefly of granite.

The Potsdam sandstone has its usual quartzose character and is overlain by a thickness of about 100′ of thin bedded sandy dolomites with interstratified layers of coarse, brown and mottled sandstone. Both types of rock contain the characteristic brachiopod Lingulepis acuminata which is recognized as one of the index species of the Potsdam sandstone. The upper formation is, however, clearly differentiated from the typical Potsdam below and the Beekmantown limestone above and it is therefore being mapped as a separate formation.

The later and overlying limestone occurs in the southern portion of the quadrangle but the boundaries have not yet been fully determined.

**Long Lake quadrangle.** The survey of this area in the heart of the Adirondack mountains has been completed and the report and map are in course of publication.

**Valcour island.** In the report of last year there was reference to the progress made by Prof. G. H. Hudson in the survey of

Valcour island, Lake Champlain. It has been the purpose to make the study of this interesting isolated area more than a discrimination of its rock formations. Valcour island is a spot of singular attractiveness for its location and salubrity; it is equally inviting for the development and accessibility of its Lower Siluric rocks and fossils. The survey of this island is being carried out on a much larger scale than the uniform topographic maps, the contours being drawn at 1 foot intervals. These investigations have led to interesting paleontological discoveries which have furnished the basis of two papers by Mr Hudson already published in the Museum bulletins.

**Highlands of the Hudson.** Dr C. P. Berkey reports the completion of the areal survey of the crystalline rocks in the Tarrytown sheet and the extension of his investigations to the West Point sheet adjoining at the north. The region about Peekskill on the southern margin of the Highlands has proved so complicated structurally and so incompletely differentiated stratigraphically that it was found advisable to defer the continuation of the mapping until these problems could be solved. With this purpose in view the whole breadth of the Highlands has been examined, especially regions of critical importance close to the Hudson river.

The following statements summarize the best established conclusions from the investigations:

1 The oldest formation of the Highlands is a gneiss, provisionally designated the *Highland gneiss* and probably equivalent to the Fordham gneiss of the New York city district.

2 This gneiss is essentially a series of metamorphosed ancient sediments chiefly silicious, now appearing as granite gneisses, quartzite schists, mica schists with occasional interbedded limestones and serpentinous beds. The whole series is abundantly interjected with sheets, stringers and dikes of igneous origin of many varieties and different dates. The most abundant types are granites and pegmatitic granites which are occasionally intruded in such large bodies as to form some of the most prominent ridges or mountains of the region. Such masses are Storm King and Breakneck Ridge. The older igneous intrusions are themselves sheared and recrystallized into gneissic structure.

3 At some places the gneiss-schist passes conformably and gradually into a quartz-schist and even into a quartzite of no great thickness. This in turn is followed by a coarsely crystalline limestone of several hundred feet thickness and, allowing for its greater mobility

in the extreme folding it has undergone, seems to be essentially conformable also to the underlying series. Conformably over this lies the great thickness of the mica schist which occurs abundantly in the region south of Peekskill to New York city. These are the equivalents of the Lowerre quartzite, Inwood limestone and Manhattan schist of former reports.

4 In other places, and commonly on the northern border of the Highlands and in the Peekskill creek valley a similar succession lies with striking unconformity on the tilted gneiss or as sometimes happens, is so faulted as to have obliterated the original relationship. The series at such places, above the unconformity from bottom to top is: a fine quartzite, 300′ to 600′, a fine grained banded limestone, about 1000′, overlain by a great but unknown thickness of shales, slates, phyllites and shaly sandstones. These series at the localities where their relationships are known are equivalents of the Cambric quartzites, Wappinger limestone and "Hudson River slates" of other reports relating to the district north of the Highlands.

5 It seems reasonable that these two types of occurrences represent two wholly different sedimentary groups, one much the older and together with the older gneiss, forming a Precambric group; the other forming a Cambric to Lower Siluric group; the two separated from each other by a time interval of unknown value. The region has been diligently searched for a satisfactory contact of the upper members of the two series with each other but thus far without success. All members of the older series are injected with igneous masses, on the contrary the upper series is nowhere cut by any kind of eruptive except by the Cortlandt series which is the latest type in the entire region.

6 There is a series of faults of great displacement bordering the Highland belt both on the north and south, in the vicinities of Cornwall on the north and Peekskill on the south. This has allowed movements of considerable areas as blocks and accounts for much of the abruptness of the change along the southern margin especially from later sediments to older gneiss. This faulting is later than Lower Siluric and was accompanied by the Cortlandt igneous activity. No later geological deposits occur in the district except the drift.

7 All the larger stream valleys were in preglacial time eroded below the sea level. Some are filled with 200′ to 300′ of glacial drift. It is more than 375′ to bed rock in the Hudson river opposite Storm King.

## Surficial geology

The field investigation of the glacial and postglacial geology of the State has been carried forward in the northern Hudson and Champlain valleys, in the Mohawk valley and in western New York. Most of this work is in direct continuation of operations already begun and in considerable measure reported. We have in press at this time reports by Professor Fairchild on the *Glacial Waters of the Erie Basin,* the *Drumlins of Central-Western New York,* and by Professor Woodworth on *Postglacial Faults in Eastern New York;* a further report by Professor Fairchild on the *Later Glacial Waters of Central New York* awaits publication.

**Schuylerville quadrangle.** Reference was made last year to the inauguration of a survey of this special district by Prof. J. B. Woodworth and this work has now progressed to its completion.

**Cobblestone Hill beaches.** This is a special investigation of a series of marine beaches in Clinton county executed by Professor Woodworth and now completed.

**Moraines of western New York.** The mapping of these features has been well advanced and will be prosecuted to completion by Professor Fairchild.

**Shore lines of Lake Iroquois, and Pleistocene geology west of the Adirondacks.** The examination and determination of these problems are in the charge of Professor Fairchild and are advancing with adequate despatch.

**Pleistocene phenomena of the Lower Mohawk valley.** Prof. A. P. Brigham has undertaken the mapping of the glacial deposits on the Amsterdam, Broadalbin, Gloversville and Fonda quadrangles.

Northville is near the north line of the district and Duanesburg and Sloansville are close to the southern boundary. Along the river the area extends from the Noses, to about Rotterdam Junction. Thus the southern Adirondacks, the Mohawk valley and the northern parts of the Catskill Plateau are represented, and the study of the area will relate itself closely to the work accomplished by Prof. J. B. Woodworth and others in the Hudson valley.

Most of the time at disposal has been given to mapping in detail and the formations have been thus delineated over the greater part of the Broadalbin quadrangle with beginnings on the three remaining quadrangles of the group.

Marked diversity appears in the thickness of the drift mantle. Thus the deposits are unusually heavy in the immediate valley of

the Mohawk and southward to the escarpment of the sandstones rising above Minaville and Glen. Massive drift also extends from Galway and Hagadorns Mills westward by Broadalbin, and beyond Johnstown and Gloversville. South of this belt and north of the Mohawk river is a region of very sparse drift, due perhaps in large part to the Tribes Hill and Hoffman faults, and the consequent exposure of the uplifted areas to glacial abrasion.

It has been noted in earlier writings that a Mohawk glacier moved westward or up the valley. Considerable new evidence in this direction has been found. The topography is "linear" and the flutings have a conspicuous east by west trend. This appears on the contoured maps and even more strongly in the field. Within the field of the Mohawk glacier about a dozen new localities of striae were found. These range through the entire field north and south of the river and have an average westward trend. Several run n. 80° w. or 10° north of west. A few show trends south of west. Doubtless the western and southern limits of this lobe will be found outside of the quadrangles named.

A separate movement is indicated for the Sacandaga valley about Northville and south and southwestward to Broadalbin and Gloversville. East and west of this much reduced area are bold spurs of the Adirondack Precambric, extending southward and forming the boundaries of what we may call the Sacandaga glacier. Here the movement was southward at Northville, becoming southwestward about Mayfield and there apparently confluent with the westward movement of the Mohawk lobe about Gloversville. The striae and drumlinoid hills confirm this conclusion as well as the trend of a considerable number of true drumlins found in the region about Gloversville and Johnstown.

From a point to the eastward of Hagadorns Mills, a belt of sand hills extends westward and has thus far been traced for a distance of 25 miles to a point at the summit of the Noses fault escarpment, west of Gloversville. Broadalbin is at the south base of this sand belt and the city of Gloversville is mainly built upon it. It is interpreted with reservation, as an interlobate moraine of the Mohawk and Sacandaga glacial lobes. Other groups of sand hills appear along the Sacandaga above Northville, below Edinburg and on the spur inclosed by the Sacandaga north of Northampton. These belong to the recession of the Sacandaga glacier. In some instances the sands are kames and a number of sand plains occur which were accumulated within retaining walls of ice. Parts

of the belt are almost a desert waste and the winds to some extent have shifted the materials and obscured the glacial topography by the formation of dunes.

Lake waters are indicated for the Mohawk valley up to the altitude of 460 feet approximate. The deposits in this body of standing water are conspicuous at Amsterdam, about Auriesville and westward from Fonda. The shore lines will be traced and the genetic relations made a subject for further inquiry.

Lake waters also occupied the Sacandaga valley from Northville southward over the great Vly which lies between Northampton and Mayfield. This body of water was apparently a glacial lake which was reduced to conditions approximating those of the present time, by the melting of the ice from the lower Sacandaga valley. Northville is at the head of an extensive delta whose deposits were built into these waters.

It is held with confidence in view of the season's studies, that the preglacial course of the Sacandaga was southward into the Mohawk near Fonda. In brief the reasons for this view are as follows. It was the natural course in view of the rapid base leveling of the sedimentary areas south of Northville, as compared with the resistant Adirondack spurs on the east and west. The drift above Gloversville and Johnstown is sufficiently heavy to form a barrier to the present issue of the waters in that direction. The rock floor of the Sacandaga is considerably lower at Northville than at Conklingville, and at the latter point the Sacandaga is constricted to a narrow gorge, within which the bed rock appears in the stream, conditions strongly suggesting that this was an ancient col from which short streams flowed toward the Sacandaga at Northampton and the Hudson at Hadley.

A hasty examination of the conditions of the Hudson about Hadley and Corinth leads to the belief that the Hudson suffered a similar diversion from the valley about Greenfield, to the present course toward Glens Falls. This hypothesis will be tested in the coming season, when it is hoped to complete the mapping of the four quadrangles, affording a basis for a report in detail.

## Industrial geology

**Mines and quarries.** The second of the series of annual bulletins on the mineral industry of New York State was prepared by the Assistant State Geologist and published in June of the current year. The series was inaugurated for the purpose of placing before

the public in a timely manner authentic information as to the distribution and economic utilization of our mineral resources. In addition to many details of new discoveries and developments, the recent issue contains a much fuller discussion of certain subjects than was given in the preceding volume. The statistics of production, likewise, have been amended, with the inclusion of returns for 1905. As a supplement to the text a list has been prepared of the individuals or firms which are actively engaged in mining and quarry operations.

There are about 30 different mineral materials occurring in the State, that have importance as a basis for commercial production, and the combined value of their product, according to the reports received last year, may be placed approximately at $35,000,000. This sum represents only a part of the actual wealth that accrues annually to the State from the exploitation of its mineral resources, since the first products upon which the valuation is calculated are susceptible of further elaboration and thus lend support to many manufacturing industries.

**Iron ores.** The investigation of the iron ore deposits has received such attention as could be commanded. The field work in the Adirondack region has been carried into Essex, Washington and St Lawrence counties and the portion of Clinton county not covered during the season of 1905. Nearly all of the mines in this section have now been visited and a large amount of material assembled for office study. It may be noted that exploration in the iron mines of this region has been active during the year, affording exceptional opportunities for collection of data on the geology and occurrence of the ores. Acknowledgment is due to those engaged in such enterprises for much valuable assistance.

One of the more important districts which has been under investigation is that of Hammondville, Essex co. These mines were very productive at one time and were prominent, as well, for the fine quality of their product. They were worked up to about 12 years ago when operations were discontinued owing to depressed market conditions. The deposits are now being tested by the diamond drill with the view to their reopening, should the results be of sufficiently encouraging character. The ore is distributed in a number of bodies, varying from small bands or lenses to masses of notable size, within an acid gneiss which resembles the rock associated with the Mineville magnetites. An examination of the district has shown that the area occupied by the ore-bearing gneiss

is much more limited than had been supposed. The formations in the vicinity have been traced with considerable care and the results will be embodied in the forthcoming report.

A small group of mines, including the Long Pond, Skiff and Schofield openings, on Skiff mountain south of Hammondville, were also visited.

Near Crown Point and extending south toward Ticonderoga there are several deposits that have been worked at one time or another, but are now inoperative. Some of the principal ones are the Breed, Kent, Butler and Vineyard. The country rock is a basic variety of gneiss, usually banded and showing indubitable evidence of sedimentary derivation. The ores are generally rich, though there is more or less pyrite present as is frequently the case with ores occurring in rocks of this character.

The Mt Defiance mine, just south of Fort Ticonderoga affords an interesting, if not unique, type of deposit among the iron mines of this section. The ore is a massive hematite filling a vertical fissure in gneiss. The walls on either side are crushed evidently by the movement which has produced the opening. Mixed with the ore there is a considerable amount of quartz and calcite. The occurrence is clearly to be ascribed to the circulation of underground waters. The reopening of the mine has been under consideration recently and an adit was started near the base of the mountain to afford access to the old workings, but has since been abandoned.

The Fort Ann, Potter and Mt Hope deposits in Washington county and the ore bodies in the vicinity of Dannemora, Clinton co., were included in the field work of the season.

On the western side of the Adirondacks, in St Lawrence county, are the Benson mines which are remarkable for their large size. Though at present closed down, they have been under energetic exploitation at different times during the last 20 years, and there is a possibility of restarting operations on a still larger scale. The deposits outcrop along the side of a ridge, offering unusual facilities for economical exploitation by open cast methods. The ore is magnetite distributed through a gangue of feldspar and quartz with an average tenor of about 35 per cent iron. By crushing and separation as was practised formerly a concentrate carrying above 60 per cent can be made.

Several other magnetite deposits occur in this region, notably at Jayville, Fine and Clifton, and have been examined. They are

much like the ore bodies found near Crown Point that have been mentioned as included in metamorphosed sediments, the ore being relatively rich but pyritic.

An undertaking which may lead to important developments for the iron-mining industry has been initiated at Lake Sanford with reference to the great bodies of titaniferous magnetites in that vicinity. Situated in one of the remotest and wildest portions of the Adirondacks, the locality was sought out in the early part of the last century by pioneer iron workers who were attracted by the reported richness of the ore and the ease with which it could be obtained. Mining was begun soon after 1830. The ore was smelted in a small charcoal furnace and the product hauled by wagon to Lake Champlain for shipment. Apparently the first attempts at making iron from the unusual ore were successful, for operations were afterward expanded by the erection of a larger furnace and a settlement of some size grew up about the works. In 1858 the industry was abruptly discontinued owing to causes that have been variously explained. Since that time practically nothing has been done toward resumption of activity until the transfer of ownership, which took place recently, brought the property into the hands of experienced mining men. During the past summer a large amount of exploratory work with the diamond drill has been accomplished and the results have gone ahead of expectations, showing that previous estimates of the magnitude of the deposits must be greatly enlarged. The Lake Sanford ore body in particular is of enormous size; the available resources within a short distance from the surface exploitable by quarry methods, run up into the millions of tons. This ore carries from 50 to over 60 per cent iron and except for occasional stringers is quite free from rock. Rich magnetite has been uncovered also in a new locality north of Calamity brook. The one drawback to the utilization of the ore is the presence of titanium, which characterizes deposits of this type associated with gabbros and anorthosites. It is hoped, however, that some solution of the difficulty will be found whereby the ore will be marketable. Experiments with magnetic separation are said to have been successful in making a product with a low titanium content, and it is possible that a portion of the crude material might be used in mixture with ores from other districts. The issue of the present venture is awaited with interest.

Field work was started in the hematite district of St Lawrence and Jefferson counties. In order to obtain a suitable base on which

to plot the geology of the mines it has been necessary to prepare a sketch map on a larger scale than any that has been published. The department cooperated in this work with the representatives of a mining company who had purposed making the survey for private use, and was thus able to secure the map at inconsiderable expense and labor. The general facts relating to geology have already been placed on the map, but owing to the lateness of the season, it was found impracticable to complete the investigation.

The ores of this district are red and specular hematites, with an average iron content ranging from 40 to 65 per cent. A number of mines have been worked at one time or another and their output amounts to a very respectable total. The principal openings lie within an area from ¼ mile to a mile or more in width, which begins a short distance from Antwerp, Jefferson co., and extends northeasterly into the town of Gouverneur, St Lawrence co., a distance of about 5 miles. The marked linear distribution observable in the deposits is conditioned by the occurrence of the associated rocks in belts having a northeast-southwest strike. The important geologic formations comprise crystalline limestones, gneiss and thinly foliated schist, all of which have been upturned and probably closely interfolded, and which are capped at times by small areas of Potsdam sandstone with a strong unconformity at the base. Both the schist and limestone, and possibly the gneiss also, belong to a series of Precambric sediments that has been thoroughly metamorphosed and subjected to erosive influences through a long period previous to the deposition of the sandstone. The schist seems to have had originally the character of a bituminous shale, for it contains much graphite evenly distributed throughout the layers, indicating an organic derivation for the mineral. There is some diversity in the occurrence of the individual ore bodies, though from a general standpoint, and particularly with respect to their origin, they are all closely related. This difference in the geologic surroundings is no doubt accountable for the many views that have been expressed by geologists who have studied them. At some localities where the Potsdam is present, the ores are gathered along the contacts with the underlying limestone or schist, and in such cases there is often apparent a transition phase with graduation upward into the sandstone. This relation has been adduced in support of the theory that the ores are sedimentary, or at least have been derived from the sandstone. The relation is not constant, however, for in some mines the bodies of ore occur wholly

within the schists and the sandstone is entirely absent. Again the existence of a peculiar rock resembling serpentine, in masses not unlike dikes has been emphasized by writers who would refer the ores to igneous sources, as it is known that serpentine generally owes its origin to alteration of basic intrusives. Still another explanation is based on the fact that bands of pyritic schist are found in close association with the deposits and involve the oxidation of the pyrite and replacement of the limestone by the resulting iron oxids. While the present work has not been carried sufficiently far to warrant, as yet, a statement of the results in reference to the relations and origin of the ores, it is believed that a comprehensive investigation of the field, which has never before been undertaken, will throw much new light on these interesting problems.

Field work on the Clinton hematite ores was undertaken by the Assistant in Economic Geology for the purpose of ascertaining more definitely the stratigraphic relations, areal distribution, variations in character and thickness of the deposits on different meridional sections along the outcrop.

In passing eastward from Niagara Falls, the Clinton ore is first encountered near Rochester where the bed has a thickness of 14 inches. The ore here rests on beds of green shale 24 feet thick, while the overlying formation is a hard limestone 14 feet in thickness. The same stratigraphic relations are found at Ontario, Wayne co., 17 miles east of Rochester, where the ore measures 22 inches. Mining operations have been conducted in that vicinity for many years and the line of workings extends about 5 miles, from a little north of Ontario village westward to Union Hill, near the Wayne-Monroe county line. The Furnaceville Iron Co. is now engaged in mining ore on its property just north of Ontario Center. The methods employed by the company, which consist briefly in the excavation of long trenches parallel to the line of outcrop, are economical and well adapted to the work. About 20 feet of soil and rock have to be removed before taking out the ore, steam shovels and derricks being used for the purpose.

The Clinton ore was formerly mined near Wolcott, 25 miles east of Ontario. A furnace was in blast here as early as 1834, but has not been in operation since 1879. The ore was obtained at a locality 4 miles east of the furnace where the bed is said to be 30 inches thick, with 20 feet of overburden. The mines are now inaccessible. Some ore was obtained also along Wolcott creek just below the furnace. The bed is here 14 inches thick, but as it lies

immediately beneath the surface soil a portion, no doubt, has been eroded away, and a thicker stratum could be secured in adjacent localities where the overlying rocks are still in place. The stratigraphic relations of the ore at Wolcott are not entirely clear. According to Hall the ore does not lie in the same horizon with the bed at Ontario, but at a higher one, and it has been suggested that two beds may be present though admittedly the two are not found at any one place. The conditions so far as they have been ascertained indicate, however, the existence of a single bed which corresponds stratigraphically to the ore at Ontario.

At Sterling Station, Cayuga co., 10 miles northeast of Wolcott, the Fairhaven Iron Co. has recently begun mining the Clinton ore. The opening is close to the former workings of the Furnaceville Co. A section of the strata, made some distance back of the outcrop, shows the ore to be 36 inches thick, with overlying limestone 18 to 24 inches, shale 55 feet and soil 10 feet.

From Sterling Station, the outcrop of the Clinton ore follows a direction somewhat south of east, approximately in the latitude of Oneida lake, but it can not be accurately delineated. For an interval of 55 miles there are no openings, the next being near Verona village where some mining was done in former years. The bed here lies close to the surface and the region is quite flat.

At Clinton, the type section of the formation, the ore outcrops on both sides of the Oriskany valley. The Franklin Iron Manufacturing Co. and C. A. Borst have mines on the east side of the valley which are now active. The principal bed and the only one at present worked is about 30 inches thick, of oolitic character. A lower bed from 6 inches to 1 foot thick separated from the upper by 2 feet of shale is sometimes present, and a nonoolitic bed, 5 feet thick, occurs 22 feet above the main bed with intervening limestones and shales. The Franklin Iron Co. smelts its product in a local furnace. The remaining output from this locality is sold to manufacturers of mineral paint.

From Clinton the ore can be traced eastward to the Sauquoit valley and has been worked at many points along the outcrop. The most easterly locality where mining has been carried on is near Washington Mills, directly south of Utica. The ore can be followed several miles farther in that direction, but it does not appear in sufficient strength to repay mining operations. In some of the eastern sections, it occurs at horizons higher than the beds at Clinton. A fine grained sandstone from 12 to 15 feet thick and carrying about 10 per cent iron is found in Herkimer county.

From Ontario on the west, to Clinton on the east, the bounds of the outcrop of the ore beds that have workable dimensions, the distance is 120 miles. If an average thickness of 20 inches is used as a basis for calculation, the quantity of ore available in each mile of outcrop and an equal distance on the dip amounts in round figures to 5,000,000 long tons. While there has not been sufficient exploration as yet to establish the continuity or the uniformity of the beds between many widely separated localities along the outcrop, yet no doubt can exist that the resources of the Clinton formation are enormous. Considering the remarkable expansion which the iron and steel industries have undergone recently, it seems not unlikely that before long these resources will be brought into more extensive utilization than has obtained at any period of the past.

It is now of immediate importance that provision be made by the Legislature for the proper estimate under the supervision of the State Geologist of the volume and quality of this great ore body. The elements of uncertainty which must be eliminated before operations for production can be intelligently begun are chiefly two: (1) the possibility of variation in thickness of this ore deposit along the dip; (2) local variations in the quality of the ore. The dip of the ore bed and adjoining strata is slight, probably not in excess of an average of 50 feet to the mile, and due south, without perceptible variations east and west. It is not possible to determine at the outcrop whether the ore body will maintain its thickness, increase or diminish in and downward. Assuming that the underground condition is as favorable as the surface, mining for a mile in along the easy slope of the strata is entirely practicable. In order to ascertain the possibility of permanence or variation it is necessary to drill through the overburden at various points south of the line of outcrop. This procedure will serve to indicate favorable points for the sinking of shafts and to determine the thickness of the soil mantle which lies heavy over much of the region involved. Such borings should traverse the field in east and west series, one at a half mile from the outcrop, the other a mile therefrom and be placed at alternating intervals of not less than 5 miles. These determinations by boring must be supplemented by assays of the ore samples obtained at each boring or so far as that may be necessary.

Assistance will be asked from the Legislature to carry out these operations.

**Sandstones.** The investigation of the sandstones has been continued and the field work has been carried into the region represent-

ing the Devonic rocks. This area covers approximately one third of the entire area of the State and quarries have been opened in all of the 25 counties of this area. The sandstone quarried is almost exclusively that which in the trade is known as "bluestone." The quarries opened in this district exceed 400 in number, the larger proportion being in the four counties of Ulster, Sullivan, Greene and Delaware.

The area producing bluestone may be conveniently divided into three districts as follows: the Hudson river district, comprising Ulster, Greene and Albany counties; the Delaware river district, embracing Sullivan, Delaware and Broome counties; and the remaining district comprising the counties of central and western New York, of which Chenango and Wyoming are the most important.

In the Hudson river district, the Devonic rocks are represented by areas of coarse sedimentation extending from the Hamilton to the Catskill formation, and quarries are operated in all the formations. Many of the quarries are located on the steep sides of the foothills or on the slopes of the southern and eastern sides of the Catskills. In the quarries thus located the overburden soon becomes so great that the quarry can not be worked far into the ridge. This disadvantage is, however, partly offset by working along the edge of the outcrop thus giving a long working face to the quarry. The quarries are located from 3 to 10 miles from the Hudson river. The product is hauled by teams to docks along the river, where it is shipped by water to various points. The product of the quarries along the Ulster and Delaware is brought to Rondout by this railroad. The principal shipping stations are Catskill, Malden, Saugerties, Glasco and Rondout. A mill for dressing the stone is located at Rondout and the stone treated here is not only from the vicinity of Rondout, but from points farther up the river as well. As a rule the producers are small ones who sell their product to dealers having docks along the Hudson river.

In the Delaware river district there has been increased activity in the quarrying business during the past year. The valley of the Delaware is here a narrow one and the quarries are located on the steep hills rising from the river valley. The roads from the quarries to the railroad are in nearly every case so constructed as to be down grade or on the level all the way from the quarry. As a rule, the quarries are larger than those of the Hudson river district and the equipment is better. The industry along the Delaware

river, which here marks the boundary line of the State, is intimately connected with that of Pennsylvania. At Parkers Glen, in Pike county, Pa., there is a mill for dressing stone and the rough material is supplied by both states. The quarries are located from 2 to 8 miles from the railroad and the chief shipping points along the Delaware in New York are Pond Eddy, Narrowsburg, Cochecton, Callicoon, Hankins, Long Eddy, Lordville, Hancock, Hale Eddy, and Deposit. The product from the quarries along the Delaware, as far north as Hancock, is all shipped by the Erie Railroad. Along the east branch of the Delaware river and Beaver creek, there are a number of quarries located on the line of the Ontario and Western Railroad. The chief shipping stations are Cadosia, Tylers switch, Fishs Eddy, East Branch, Trout Brook, Cook Falls, Roscoe and Livingston Manor. A mill for the treatment of the quarry product is located at Tylers switch. A new railroad is in course of construction from East Branch along the east branch of the Delaware river. As the stone is of good quality a number of operators are contemplating opening quarries along the line of this railroad.

North from Cadosia the quarries in central Delaware county were visited. The principal quarries here are located in the vicinity of Walton. Westward from Walton is the Susquehanna valley. No large amount of bluestone is produced here. The quarries which are in operation are in the vicinity of Oneonta.

West of the Susquehanna is the Chenango valley. The principal quarries here are located at Oxford and Norwich. The large quarry at Coventry is no longer in operation. The output of the quarries at Oxford and Norwich is mostly building stone of which a large amount is annually produced. The mill formerly located at Oxford has, during the past season, been moved to Norwich where the conditions are economically more favorable for quarrying.

In western New York the most important quarries are located at Warsaw and Portageville in Wyoming county. Almost the entire product of these quarries is sold for building material. The rock of these quarries is softer than in eastern New York and channeling machines are used to advantage.

In addition to the above quarries in western New York, a number were visited in the vicinity of Cayuga and Seneca lakes. A line of quarries in the Cashaqua division of the Portage extends from Ovid Center to Taughannock Falls. None of them is in steady operation at present. One quarry is being worked at Kings Ferry on Cayuga lake. The quarries at Ithaca were also visited. The

production here is mostly for local use. These quarries are in the Ithaca formation and those at Oxford and Norwich are of the Oneonta horizon. A brief visit was made to the quarries at Elmira. The quarries just to the east of Elmira, at Horseheads and at Pine Valley are in the High Point sandstone, one of the higher divisions of the Portage-Chemung. Those at Warsaw and Portageville also belong to the High Point or Portage sandstones. Quarries in the Chemung formation have been opened to the south of Elmira and in Allegany, Cattaraugus and Chautauqua counties, but they have not been examined in detail.

### MINERALOGY

The research work in mineralogy during the past season has been confined principally to the crystallography and genesis of New York occurrences of minerals, the results of which have been incorporated in a paper now in press on the minerals of Lyon Mountain, N. Y. This investigation attacks the problem of the conditions affecting the deposition of calcite as expressed by the crystal habit. Some interesting conclusions were reached which confirmed the results obtained in a previous paper on the calcite of Union Springs.[1] Three new crystal forms are added to the list for calcite, as well as some highly interesting combinations and groupings. Some interesting twin crystals are described and figured under albite and some rare and interesting combinations under stilbite, titanite and apatite.

The curatorial work of the section has been much reduced through the abandonment of the exhibited mineral collection last December.

The work of collecting new material both for research study and for an enlarged and improved mineral collection has progressed with gratifying results. A fine series of minerals from the Sterling mine, Antwerp, was added to the already good collection from this locality. These included two specimens showing garnierite associated with millerite, and four specimens of goethite, both of which species are new from this locality. The goethite occurs as radiating tufts of light brown crystals like fine camel's-hair brushes. These are found on the surface of quartz and dolomite which line the cavities in the red hematite.

A series of 45 specimens of zircon in quartz and oligoclase was collected from a reopening of the old locality at Mineville. These equal in size and development the zircon crystals formerly obtained from this locality.

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[1]N. Y. State Mus. Bul. 98.

A new locality for brookite was found by Mr C. A. Hartnagel in the limestone exposure at Indian Ladder, Albany co., two specimens being obtained as the result of a careful search. These occur embedded in calcite, differing in this respect from the Ellenville occurrence, to which, in other respects, they bear a marked resemblance. The crystals are very small, the larger measuring 1 mm in length.

A hitherto unnoted locality for tourmalin in the vicinity of Fort Ann was visited and several specimens obtained. The largest of these is a broken black crystal embedded in quartz and measuring 30 cm in length and 20 cm in diameter. Although showing no termination, it is well developed in the prismatic zone and shows the typical cross-section for tourmalin. A smaller specimen measuring 8 cm in length and 10 cm in diameter shows several well defined planes of the termination.

Some large orthoclase phenocrysts were obtained from a pegmatite exposure 1¾ miles northwest of Crown Point Center, Essex co. They occur in a coarsely crystalized matrix of quartz and orthoclase and show well defined crystal outlines. The largest of these phenocrysts measures 21 by 6 cm.

A number of large and well developed crystals of calcite were collected from the old eupychroite deposits 1 mile south of Crown Point. The calcite from this locality crystallizes in twinned rhombohedrons of the form R (1011) the largest of which measures 7.5 cm on edge. In the twinning habit they resemble the calcite from Rossie and other St Lawrence county localities, the twinning plane being parallel projections observed on the rhombohedral faces proved to be the incipient development of a twinning parallel to a hypothetic plane — ½ R. The crystals which are in general clear and colorless are in many instances thickly coated with stalactitic calcite.

A fine series of 140 calcite specimens was collected by the State Geologist from Percé rock, Gaspé, Can. These are clear to milky white in color and are superficially colored in many instances by a thin coating of a flesh-colored to red deposit of iron oxid derived from hematite. Barite and fluorite also occur associated with the calcite. The occurrence which presents some interesting crystallographic combinations, may be made the subject of a more detailed description.

The attention of the Assistant State Geologist was recently directed to the occurrence of fine calcite crystals in a limestone quarry

in Lewis county. The quarry is on the eastern slope of a ridge of dolomitic limestone extending northeast and southwest, the exposed face rising to a hight of about 35 feet. At a hight of approximately 20 feet from the base of this exposed face, the limestone has been hollowed out to form an irregular cavern, the wall, roof and floor of which were covered with calcite crystals, some of enormous size. At the time of the visit a portion of the walls of this cave had been removed in the operation of quarrying the limestone. Access to the cave was gained through an opening about 4 feet in diameter. Inside this opening the cavity expands to a cross-section of about 10 feet in width by 5 feet in hight, running back for a distance of some 20 feet when it suddenly contracts to a small passage about 4 feet in cross-section, rather winding, but extending downward in a general direction for a distance of about 20 feet, gradually narrowing to a size which rendered it impossible of access.

Many of the largest crystals were found in the outer portion of the cave, the roofs and walls of which were thickly covered with calcite crystals of all sizes. Fewer and smaller crystals were encountered in the inner cave where they were found mostly attached to the roof and sides.

The crystals are of unusual size, the largest taken out measures 3′ 7″ by 3′ 1½″ by 1′ 6″ and weighs approximately 1000 pounds.[1] A number of smaller crystals ranging in weight from 100 to 500 pounds were obtained, besides several large slabs covered with smaller crystals and a vast amount of small specimens representing single crystals and groups. In all about 12 tons of material of exceptional beauty and interest were taken from this locality.

In habit the calcite crystals resemble those from Rossie, St Lawrence co. They show a strong tendency toward the formation of penetration twins parallel to a composition face OP which is present as a well developed plane. This twinning habit finds expression in deep reentrant angles or "channels," well shown in the adjoining plate and produced by corresponding planes of R (1011) in twinned position.

On a number of crystals repeated twinning according to this law was noted; in one instance as many as four repetitions of the twinning habit being observed. The abnormal development of the basal plane produces a tabular aspect quite characteristic of the occurrence. The lateral edges of the primitive rhombohedron are modi-

[1]The largest calcite crystal of which a record is accessible is one from Eskifjördhr, Iceland, at present in the British Museum. It measures 2′ 6″ by 1′ 6″.

fied by one or more scalenohedrons. A more detailed description of these interesting crystals is reserved for a later paper. It suffices, however, to mention here that they present an interesting study both of crystal form and twinning habit.

Many of the crystals which were found lying loose on the floor of the innermost portion of the cavern, were completely developed on all sides, showing no point of attachment. This fact which is sufficiently remarkable in crystals of this size may lead to some interesting speculations as to the manner of their production and the character of the crystallizing solution. Many of the largest crystals obtained from the outer cave were attached to the wall by a relatively small portion of their total surface so that it was possible to detach them by very little effort.

One of the most striking characters of these crystals is a delicate amethystine to pink color shown on a large majority of the specimens and which renders them singularly beautiful. The color appears to be irregularly distributed throughout the mass and shows deeper in the outer portions of the crystals. A tendency toward the concentration of color parallel to definite planes, notably the planes of cleavage is evident. Calcite crystals similar in color have recently been found in the Maybell mine at North Empire, Kan., and have been described by Sterrett,[1] who notes a similar lack of uniformity in the distribution of color. A dendritic deposit of pyrolusite observed on the termination of some of the small crystals from the outer cave indicates the derivation of the color from a minute percentage of manganese.

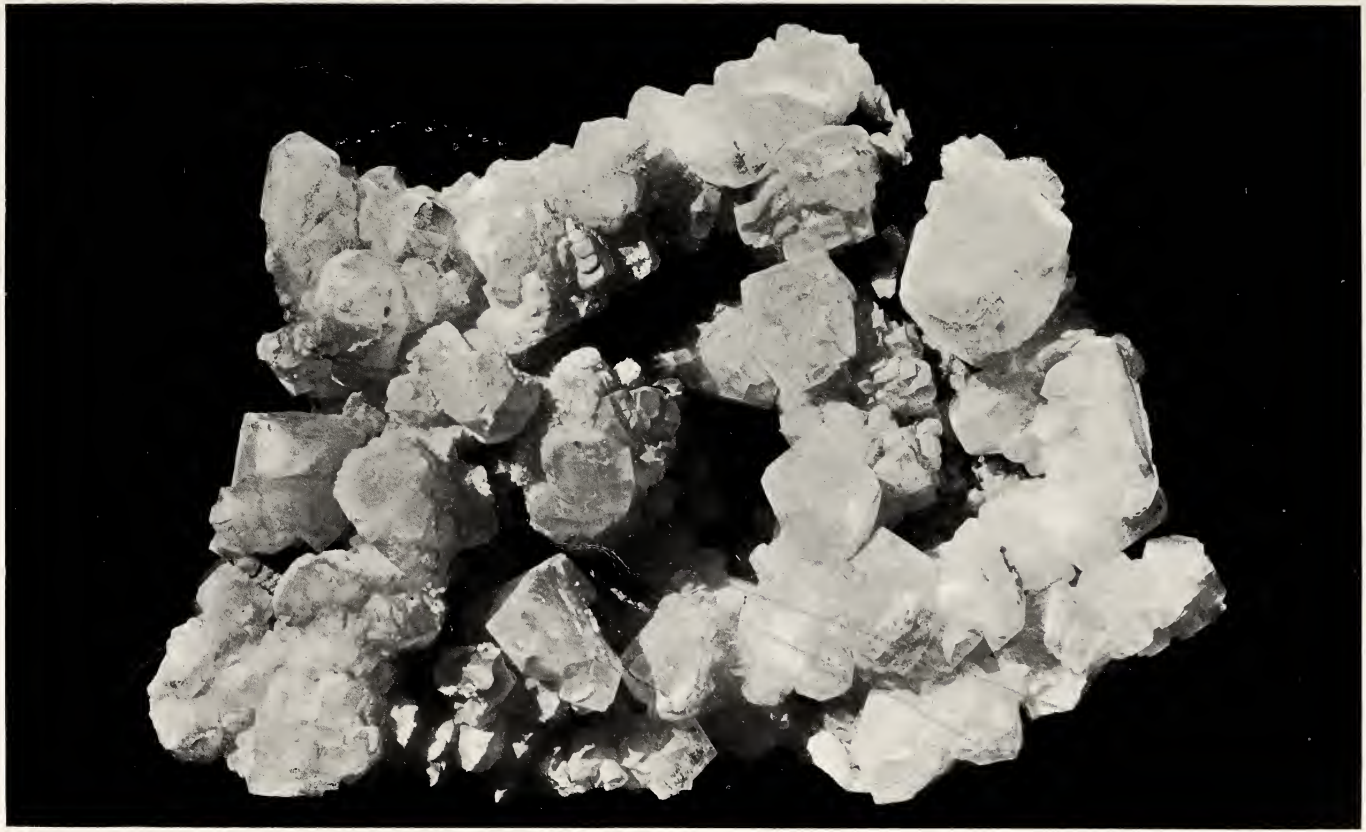
Secondary aragonite occurs as an incrustation of minute acicular crystals on some of the calcite representing an early generation. Some quartz was noted associated with the calcite of this stage. Although considerable stalactitic calcite was observed coating the surface of the large crystals, very little evidence of true stalactitic formation was to be found on the roof, walls and floor of the cavern. One slender stalactite which measured 12.8 cm in length and .5 cm in diameter was hollow for about one third of its length and was lined with crystallized calcite. This, together with the remarkable size of the calcite crystallization, points to a condition of extremely slow deposition of lime carbonate from a solution which must have remained undisturbed during the entire process of crystal deposition.

[1] Sterrett, D. B. A New Type of Calcite from the Joplin Mining District. Am. Jour. Sci. 1904. 18:73.

Plate 1

Crystal twinned parallel to the basal pinacoid. The composition plane shown in horizontal position

Group of crystals showing repeated twinning parallel to the basal pinacoid which appears in the illustration as a triangular face, the orientation of which corresponds to the two twin positions. The specimen well illustrates the characteristic deep "channels" produced by this law of twinning.



Group of crystals from wall of cavern, showing crust of secondary aragonite

The secondary twinning parallel to a hypothetic plane — ½ R which was previously noted in connection with the calcite from Crown Point, is developed to a marked degree in these crystals where it takes the form of parallel systems of sharp ridges protruding from the surfaces of the planes of both R and OP. On one crystal, the basal plane of which measures 15.6 cm on the bounding edges, one of these projections measures 4 cm in length and .5 cm in hight.

### EARTHQUAKE RECORDS

The seismograph installed in the basement of Geological Hall was placed in operation on March 10, 1906. It has furnished since that time a number of records which fully demonstrate its mechanical efficiency and its utility as an adjunct to the Museum's scientific equipment. Similar instruments have been in use for some time in Baltimore, Washington and Cheltenham, Md., but with these exceptions there are no other stations throughout the entire eastern section of the country where the investigation of seismic phenomena is proceeding at the present time. The records have an independent value as a measure of the character of earth tremors experienced in the region, while at the same time it is hoped they will contribute to the general advance of this line of work which is now receiving attention and support in many parts of the world.

The disturbances thus far registered at Albany have originated at remote points, none of them nearer than 2500 miles. In some cases, however, the wave motions traced by the instrument have been marked in their intensity, showing that local conditions are not unfavorable to their transmission. The fact that no earthquakes could be traced to near-by sources can not be regarded as indicative that the region lies without the bounds where sensible movements originate, for observations must be extended over a much longer period of time before any conclusions are warranted as to the occurrence and relative frequency of local readjustments such as give rise to earth tremors.

In explanation of the accompanying data relating to the seismograph records, it may be stated that the instrument used belongs to the horizontal pendulum type. It is an invention of Omori, the distinguished professor of seismology at the University of Tokio, and has been later improved by the makers, Messrs J. & A. Bosch, Strassburg, Germany. The instrument is placed on a concrete pier set into the ground to a depth of 3 feet and resting upon

undisturbed strata of clay. The distance to solid rock is not known. The pier is isolated from the ground by a narrow trench extending on all sides of the base of the foundation. There are two of the horizontal pendulums, one placed so that its axis lies east-west and the other north-south when at rest. They are supported by standards at one end while the outer extremities carry massive lead weights to which are engaged recording arms delicately pivoted and capable of adjustment so as to magnify or diminish at will the motion imparted to them. A multiplying ratio of 10 has been found to give good results at Albany. The recording arms register the movements by means of a needle, the point of which is in contact with a band of smoked paper wound around the outer surface of a drum. The drums are driven by clockwork at the uniform speed of one revolution an hour; their axes are cut with screw threads which cause them to move laterally as they revolve. An independent clock of better construction serves to record the shorter time intervals by opening an electric circuit which, passing through small magnets, causes an arm to press down upon the paper at the lapse of each minute. While in operation the instrument thus traces a continuous line in the form of a spiral on the smoked surface of the paper which also shows a series of dots regularly spaced representing the minute intervals. When the record is removed from the cylinder and stretched out in a plane, the spiral line becomes, of course, a series of parallel lines. In case any disturbance has occurred during the time of making the record, the line shows a series of wave motions of greater or less amplitude according to the violence of the disturbance.

The following constants are given in connection with the description of the records to facilitate comparison with those obtained at other stations. The latitude of Albany is n. 42° 39′ 6″ and the longitude w. 73° 45′ 18″. The foundation of the instrument is approximately 85 feet above sea level. Each pendulum including arm weighs 24 pounds 14 ounces or 11.283 kilograms, and the distance of center of gravity from rotating axis is 84.6 centimeters. The period of the pendulums (time required for a complete swing) during the time in which the instrument has been operated, has been found to vary, and it has been necessary to readjust them occasionally in order to obtain satisfactory results. Each readjustment involves a slight change in the period. It has been the aim to maintain a period of about 30 seconds and the variations have usually not exceeded five seconds.

RECORD OF EARTHQUAKES AT ALBANY

APRIL 10 TO OCTOBER 1, 1906

Standard time

| Date | Beginning preliminaries | Beginning principal part | Maximum | End | Max. amplitude | Multiplying ratio |
|---|---|---|---|---|---|---|
| | h. m. | h. m. | h. m. | h. m. | mm. | |
| Apr. 10..... | 4 29 p.m. | 4 41 | 4 41½ | 5 27 | 35 | 12 |
| Apr. 18..... | 8 21½ a.m. | 8 32½ | 8 35 | 11 5 | 65 | 10 |
| Apr. 18..... | 7 48 p.m. | ..... | ..... | 8 0 | ..... | 10 |
| Apr. 23..... | 4 28 a.m. | ..... | ..... | 4 35 | ..... | 10 |
| Aug. 16..... | 7 33 p.m. | 7 47 | 7 55 | 9 0 | 110 | 10 |
| Sept. 14..... | 11 37 a.m. | 12 5 | 12 10 | 1 13 | 25 | 10 |
| Sept. 28..... | 10 32 a.m. | 10 36 | ..... | 10 43 | 6 | 10 |

**April 10.** A small but well marked disturbance probably a preliminary to the earthquake of April 18 but possibly of Porto Rican origin. The larger vibrations were registered on the north-south pendulum, showing that they came from nearly an east or west direction. The period of the maximum waves was about 24 seconds. The disturbance was recorded also at the Washington and Baltimore stations.

**April 18.** This is the violent earthquake which originated on the Pacific coast, known as the San Francisco earthquake. It was registered at all the seismological stations in this country and at many places in Europe. The records obtained at Albany were excellent as the pendulums were in perfect working order at the time. A comparison of the two tracings shows the east-west component of the vibrations to be more pronounced, though a single long swing in the north-south component had the greatest amplitude, 65 mm as compared with a maximum of 48 mm in the former direction. The duration of the preliminary tremors covered nearly the same period as in the earthquake of April 10, indicating that both traveled approximately the same distance. The slight disturbance in the afternoon of April 18 was probably a reflex of the main shock.

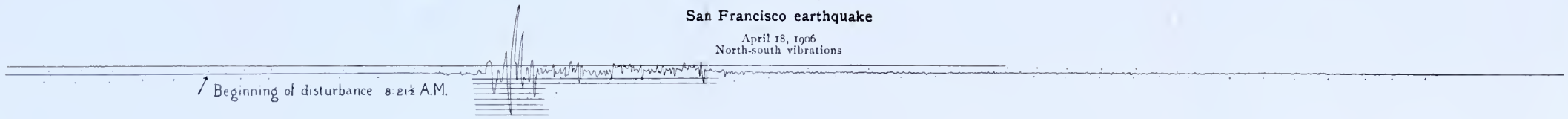
**April 23.** Faint vibrations, but undoubtedly of seismic character. Main component was in an east-west direction.

**August 16.** This earthquake originated near Valparaiso, Chili, and was of even greater violence than that of April 18. The records obtained show the strongest vibrations of any disturbance registered thus far. The east-west component of the vibrations has the larger amplitude during the principal part of the disturbance, but the north-south component is more marked throughout the entire period. Near the beginning of the main vibrations, the pointer of the north-

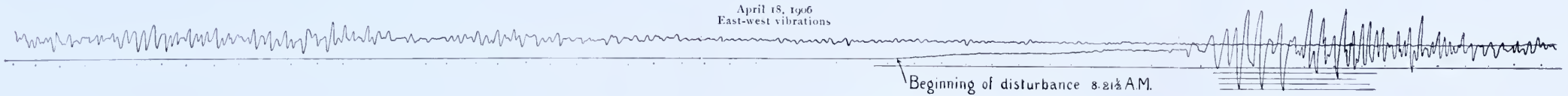
SEISMOGRAMS

## San Francisco earthquake

April 18, 1906
North-south vibrations



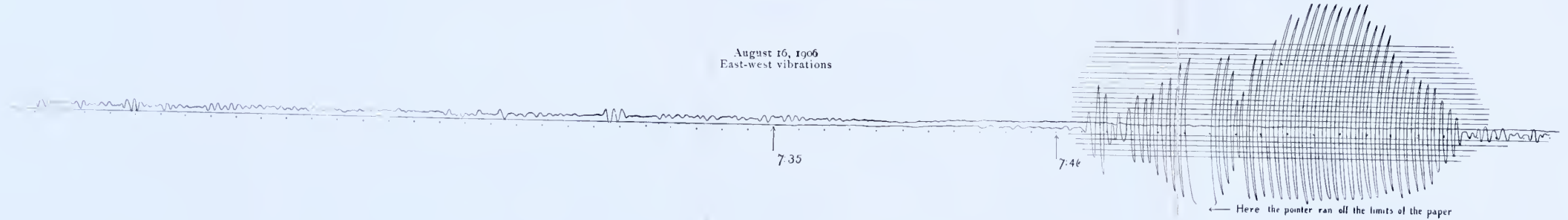

April 18, 1906
East-west vibrations




## Valparaiso earthquake

August 16, 1906
North-south vibrations


August 16, 1906
East-west vibrations



RECORD OF EARTHQUAKES AT ALBANY

APRIL 10 TO OCTOBER 1, 1906

Standard time

| Date | Beginning preliminaries | Beginning principal part | Maximum | End | Max. amplitude | Multiplying ratio |
|---|---|---|---|---|---|---|
| | h. m. | h. m. | h. m. | h. m. | mm. | |
| Apr. 10..... | 4 29 p.m. | 4 41 | 4 41½ | 5 27 | 35 | 12 |
| Apr. 18..... | 8 21½ a.m. | 8 32½ | 8 35 | 11 5 | 65 | 10 |
| Apr. 18..... | 7 48 p.m. | ..... | ..... | 8 0 | ..... | 10 |
| Apr. 23..... | 4 28 a.m. | ..... | ..... | 4 35 | ..... | 10 |
| Aug. 16..... | 7 33 p.m. | 7 47 | 7 55 | 9 0 | 110 | 10 |
| Sept. 14..... | 11 37 a.m. | 12 5 | 12 10 | 1 13 | 25 | 10 |
| Sept. 28..... | 10 32 a.m. | 10 36 | ..... | 10 43 | 6 | 10 |

**April 10.** A small but well marked disturbance probably a preliminary to the earthquake of April 18 but possibly of Porto Rican origin. The larger vibrations were registered on the north-south pendulum, showing that they came from nearly an east or west direction. The period of the maximum waves was about 24 seconds. The disturbance was recorded also at the Washington and Baltimore stations.

**April 18.** This is the violent earthquake which originated on the Pacific coast, known as the San Francisco earthquake. It was registered at all the seismological stations in this country and at many places in Europe. The records obtained at Albany were excellent as the pendulums were in perfect working order at the time. A comparison of the two tracings shows the east-west component of the vibrations to be more pronounced, though a single long swing in the north-south component had the greatest amplitude, 65 mm as compared with a maximum of 48 mm in the former direction. The duration of the preliminary tremors covered nearly the same period as in the earthquake of April 10, indicating that both traveled approximately the same distance. The slight disturbance in the afternoon of April 18 was probably a reflex of the main shock.

**April 23.** Faint vibrations, but undoubtedly of seismic character. Main component was in an east-west direction.

**August 16.** This earthquake originated near Valparaiso, Chili, and was of even greater violence than that of April 18. The records obtained show the strongest vibrations of any disturbance registered thus far. The east-west component of the vibrations has the larger amplitude during the principal part of the disturbance, but the north-south component is more marked throughout the entire period. Near the beginning of the main vibrations, the pointer of the north-

south pendulum swung off the paper and failed to register for a period of one second. The larger amplitude of the waves recorded by that pendulum may have been due to more sensitive adjustment.

**September 14.** A moderately strong movement recorded principally on the north-south pendulum. Origin is not known.

**September 28.** Slight disturbance, consisting of small waves separated by intervals of quiescence. Main component registered by the north-south pendulum.

### LIMESTONE CAVERNS OF EASTERN NEW YORK

In my report of last year attention was directed to the desirability of acquiring more exact evidence of the character and origin of the caverns which honeycomb the limestone region of the Helderberg plateau. There are many of these subterranean ways. They have long been known to the residents of the region and have been a source of popular interest partly because of the mysterious obscurity in which they have been veiled. Their geological importance lies chiefly in the relation of such underground passages to the topography and drainage of the country, for this class of caverns is elongated channels produced either by solution of the limestones or by subterranean erosion. The Helderberg plateau has been well adapted to their development because of its peculiar though simple geological structure. The region is one of continued succession of limestone beds varying in degree of purity and the strata in general are almost horizontal, whatever dip they have being to the south.

In the consolidation of these strata and by the strains they have undergone in their uplift they have been deeply cracked or parted without displacement of adjoining masses, by an intricate series of vertical joints which has made the floor of the region a mosaic of great limestone blocks. When solution or erosion has begun on this area, it naturally selects these lines of least resistance and the ultimate outcome is the production of cavernous channels in the rocks. It is thus entirely clear that essentially the whole system of underground channels stands in direct relation to and constitutes a part of the drainage system.

With the purpose of ascertaining these relations a party was organized during the past season, instructed to explore and survey all accessible caverns in this limestone plateau and to take note of their relations to geological structure, drainage, topography and organic contents. The work was prosecuted with vigor though it

was arduous and venturesome, involving risks to person which few would care to take. The results have been entirely satisfactory in solving the general problem above specified. Prof. John H. Cook was placed in charge of the work, having as assistants James F. Loughran, surveyor and Harry C. Cook, photographer.

The cave-bearing limestones of the Helderberg and Schoharie region are a part of a consecutive series which are geologically classified as follows from below upward:

At the bottom are the shales of the Hudson River complex, which in the eastern part of the region are unconformable with the beds above. Then follow in ascending order:

Ontaric or Upper Siluric
- Brayman shale
- Cobleskill dolomite
- Rondout dolomite
- Manlius limestone

Lower Devonic
- Coeymans limestone
- New Scotland calcareous shale
- Becraft limestone

Above these limestone beds follows a series of sandy and silicious rock strata which are not the locus of caverns. These are:

Lower Devonic
- Oriskany quartzite
- Esopus grit
- Schoharie grit,

all capped by the Onondaga limestone in which again caverns appear.

The upper terraces and summits of the plateau are constituted of sandstones and shales of Middle Devonic age and are not cavernous.

Professor Cook has submitted the following preliminary account of his researches.

In the Siluric and Devonic rocks of Schoharie and Albany counties there are three cavern zones which may be designated as the Onondaga, the Becraft and the Manlius. The first and second are sufficiently characterized by their names but the unbroken succession of lime rock formations between the Coeymans limestone and the Brayman shale (or, where this is absent, the Lorraine beds) must be regarded as a unit and the name Manlius applied to this zone is more or less arbitrary.

In this investigation it soon became evident that the subsurface drainage is dependent upon the geological structure of the region

in a way that renders the interpretation of the caverns a simple matter and affords some basis for a systematic prosecution of the work.

The influences controlling this drainage may be summed up under these heads: (1) the character of the successive terranes and the topographic forms resulting therefrom, (2) the strong southwest dip of the strata, and (3) the insequent stream valleys which have been cut in the peneplain to the level of the cavernous horizons.

The normal retreat of the Helderberg escarpment along its northern and eastern face results in a series of terraces caused by the removal of the soft strata from between the harder, and the differential retreat of the terraces has left in places wide areas of permeable limestone exposed to the action of percolating water. Plateaus of variable extent are formed by the Onondaga, the Coeymans and, west of the Cobleskill creek (where the Oriskany quartzite appears to be absent or very thin), by the Becraft limestones.

When carbonated and acidulated meteoric water has once found its way into the joints and between the beds of the limestones thus rendered accessible, the excavation of caverns by solution will begin, provided the water can find an outlet at a level below that of its point of entrance into the rock. But the inclination of the strata southward precludes the possibility of exit above the line of strike passing through that point and, excepting along that part of the Helderberg escarpment which trends southeastward from near Altamont, it is only where a surface stream has cut its valley to the requisite depth and below the line of strike that an outlet is afforded. It is evident, therefore, that the age of these underground channels can be approximately fixed by estimate of the time at which their mouths were uncovered; and caverns of the same zone may be compared in this regard by reference to their distance from the head of the valley into which they open.

The diameter attained by a cave is primarily dependent upon the amount of water passing through it and the relative solubility of the rock. Disregarding meteoric conditions the volume of water is largely governed by the topography of the area drained by underground passages, the changes caused by surface erosion and the deposit of glacial material having in this way affected the Helderberg caverns considerably.

The life of a cave ends when the roof gives way and the channel is opened to day, a fate which may overtake it early in its development or be postponed for a long time, but is inevitable. As the


ower Gall
ower Gall
VE.

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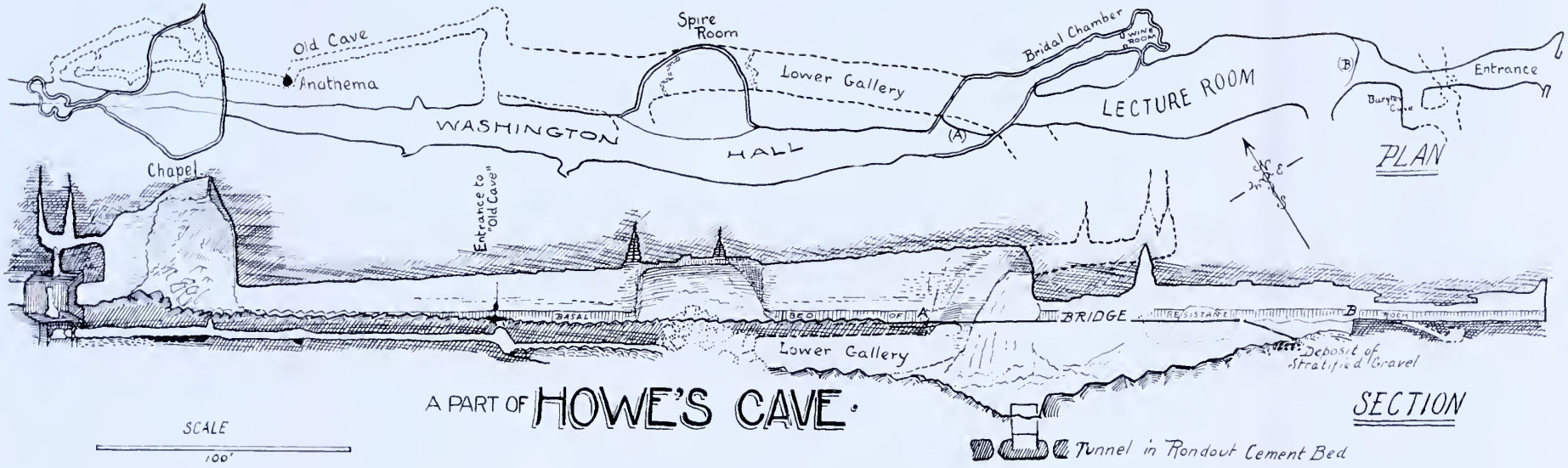



# A PART OF HOWE'S CAVE.

cavity is enlarged beneath thin or loosely coherent beds, these, deprived of support, fall into it and unless beds sufficiently firm to maintain their position lie above, the cavern will speedily be reduced to a ruin. Such "dead" caverns have a notable effect on topography, produce small sink holes or large rock basins with or without outlet and inlet. Though dead as caverns these areas may still be active fields of solution and erosion. Some instructive instances of such topographic forms, *Karsten,* resulting from the falling in of the caverns are to be seen on the Helderberg plateau.

Ideal conditions for the formation of large caves in thin-bedded limestone are furnished by the succession of hard and soft strata composing the Manlius zone. The Manlius is the cavern formation proper though passages in the Rondout and Cobleskill strata have been worked out where favorable conditions exist. The massive and resistant Coeymans limestone which yields slowly to erosive forces serves as a solid roof and a protection for the weaker rock beneath. The openings in the Coeymans limestone are all of the nature of deep vertical shafts worn along joint planes, and occasionally extending through the Manlius beneath. These shafts, locally known as "rock holes" occur at the bottom of broad trenches cut in the overlying New Scotland shale or upon high land where the shale has been nearly or quite removed. In the former case they receive the drainage of a considerable area and may be assumed to be in process of development; in the latter little or no water reaches them, their development together with that of the passages leading from them is at an end and they are of importance only as indicating former lines of surface drainage.

In this zone the main channel of every cavern investigated lies at the base of the Manlius, showing that the first water to penetrate the rock met with little opposition in making its way through the beds above that level. Some of the side passages for a greater or less distance from the foot of the shafts in which they originate, have been excavated above resistant beds higher in the series and in Howe's cave certain parts of the axial cavity have been formed by the deepening of channels first excavated in the upper strata (notably the "Bridal Chamber" and "Washington Hall") and other parts by the undermining of such channels (as the section filled by the "Rocky Mountains").

Little could be learned of the caverns in the Becraft limestone; three were found but only one was accessible. It appears from the evidence obtainable that solution begins in the lowest beds,

subsequent enlargement being principally due to the falling of slabs from the ceiling and their removal by the water.

The structure of the Onondaga limestone caverns can not be determined from the single cave visited at Clarksville and the short sections of passages accessible in the neighborhood of Thompsons Lake. The character of the arch in the heavier beds is quite distinctive but where thinner beds have been undermined the floor is littered with fragments of limestone much as in the larger Manlius caves.

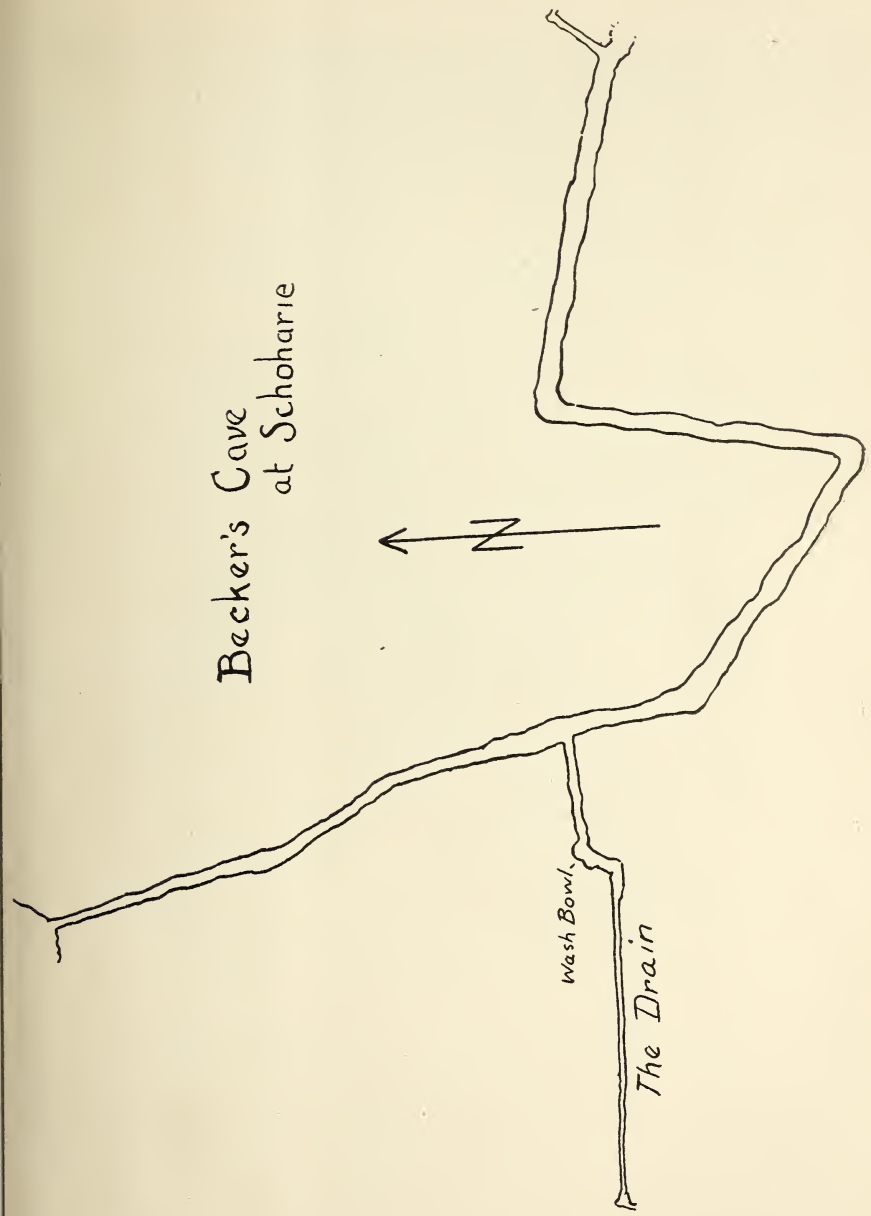
## Section I

## Caverns of the Schoharie valley

**Becker's cave** is located under Lasell park in the village of Schoharie. The entrance at the bottom of the low cliff behind the Lutheran cemetery opens near the base of the Manlius and clearly does not represent a mouth of the cavern. For 115 feet the passage is just high enough to enable one to creep, is between 2 and 5 feet wide and slopes noticeably downward. This part is nearly straight, the general direction being s. 15° e. (magnetic). It broadens gradually to 10 feet toward the further end where the floor drops sufficiently to permit of standing erect. Here a drain has been developed in the west wall. This is fairly commodious for 38 feet but drops abruptly to harder beds upon which the water has acted more slowly and the remainder of the passage which extends due west for 68 feet as a widened joint can be traversed only by lying flat. At the further end a crevice in the floor too small to penetrate serves to carry off the water to still lower beds, probably the Rondout dolomite.

The main passage was followed for 230 feet beyond the drain [*see* accompanying map] to where a small side passage enters from the north. Further exploration was prevented by ponded water and a low roof. This part of the cave is half full of clay and one must progress on hands and knees for almost the entire distance. No stream was flowing through it at the time of this visit and the pools contained no life. Neither stalagmites nor stalactites were found.

**Clark's cave** is on the opposite side of Schoharie creek about a quarter of a mile north of the Gebhard bridge. It opens in the lower Rondout beds and its explorable extent is less than 50 feet. To clear away the clay and rubbish which has accumulated about the mouth and thus drain off the water which fills it, would involve the expenditure of an amount of time and labor deemed unjustified in this preliminary survey.


Backer's Cave
at Schoharie
N
Wash Bowl
The Drain

**Shelter cave** is the name given to a small cavern in the cliff back of the house of Mr Samuel Clark on the same side of the creek. It is excavated from the basal beds of the Becraft limestone, is dry except in the spring and after exceptionally heavy rains and can be penetrated for some 25 feet by a small person lying flat.

The Schoharie valley does not occupy a position favoring the supposition that a large cavern may open into it. Cut off from the plateaus to the north by the Cobleskill and Fox creeks, the terraces bordering it succeed one another too rapidly to afford any very extensive gathering ground for surface waters. The only opportunity offered would be where a stream coursing down the hillside had found access to the soluble limestones through heavily jointed beds. This is said to be the case where the brook flowing down the north face of Sunset hill at East Cobleskill crosses the Onondaga.[1]

## Section II

### Caverns of the Cobleskill valley

The Cobleskill valley receives underground drainage from the region north and west of it. All caves indicated by "rock holes" or streams disappearing in the limestones of this area as far as the Mohawk river undoubtedly open into this valley. Between Central Bridge and Braymanville the mouths of those of the Manlius zone are to be looked for. Only two were found but the existence of several others is indicated by springs.

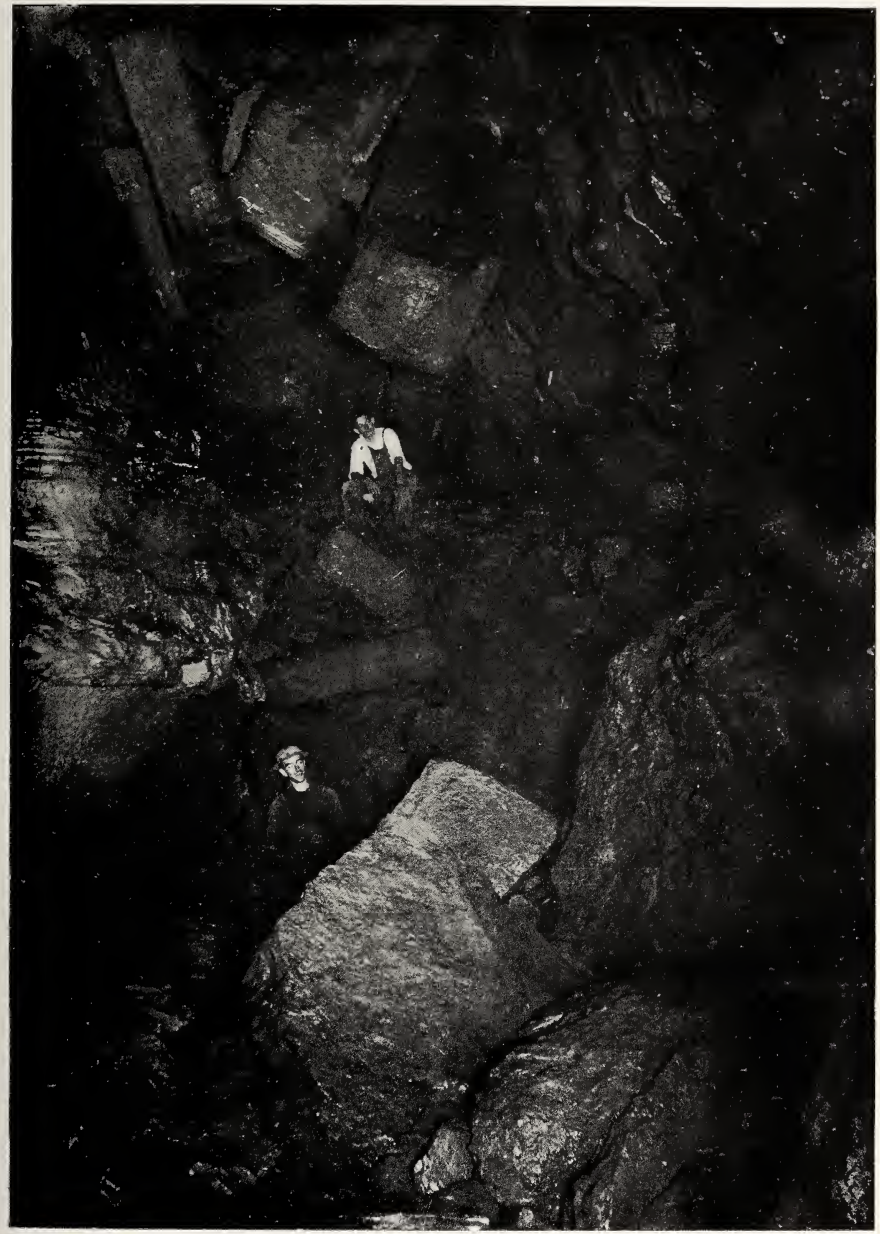
**Howe's cave** is the largest cavern thus far discovered in the State. It is located 40 miles from Albany on the line of the Delaware and Hudson Railroad. The entrance is at the base of the cliff back of the hotel. The accessible part of the axial cavity extends for 4411 feet in a generally northwest direction and throughout its length the true floor, though for the most part covered by clay and fallen blocks of limestone, lies near the bottom of the Manlius where a series of resistant beds has formed what may be called a base level of ready solution above which the original channel was made. Ten side passages enter the cave from the north and the existence of six others coming from the same direction is to be inferred. Only one is of any considerable length and all the smaller ones are filled with clay or calcite. A fair-sized stream coming from a pool which fills the continuation of the cavern flows through the main cave to within 1160 feet of the en-

[1]Grabau, A. W. N. Y. State Mus. Bul. 92, p.193.

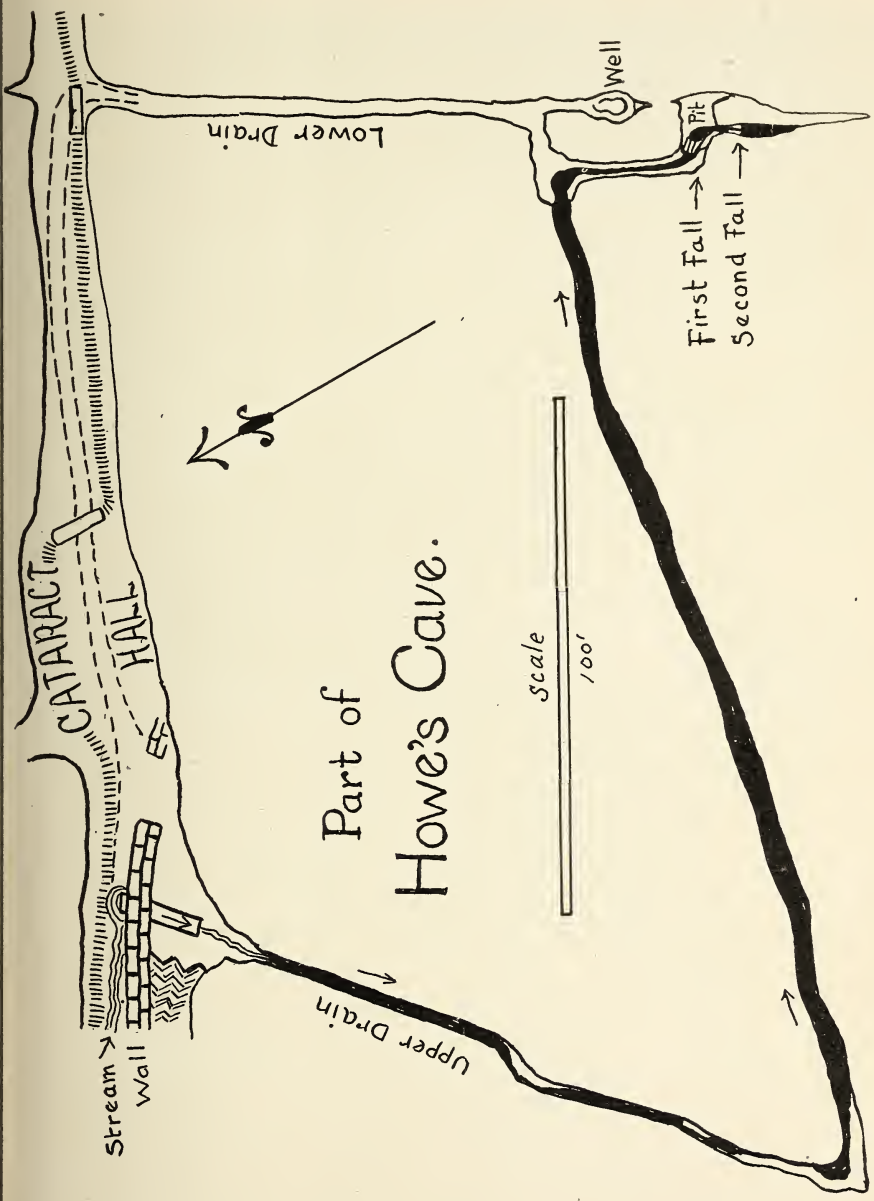
Howe's cave. Stalactitic formations at the upper end of the "Lake"

Howe's cave. The "Giant's Chapel," looking toward "Washington Hall." All but the lowest beds of the Manlius limestone are exposed in this room. The ceiling is of Coeymans limestone.

Plate 6



Howe's cave. The "Rocky Mountains" from the "Valley of Jehosaphat"


Part of
Howe's Cave.
CATARACT
HALL
Stream
Wall
Upper Drain
Lower Drain
Well
Pit
First Fall
Second Fall
scale
100'

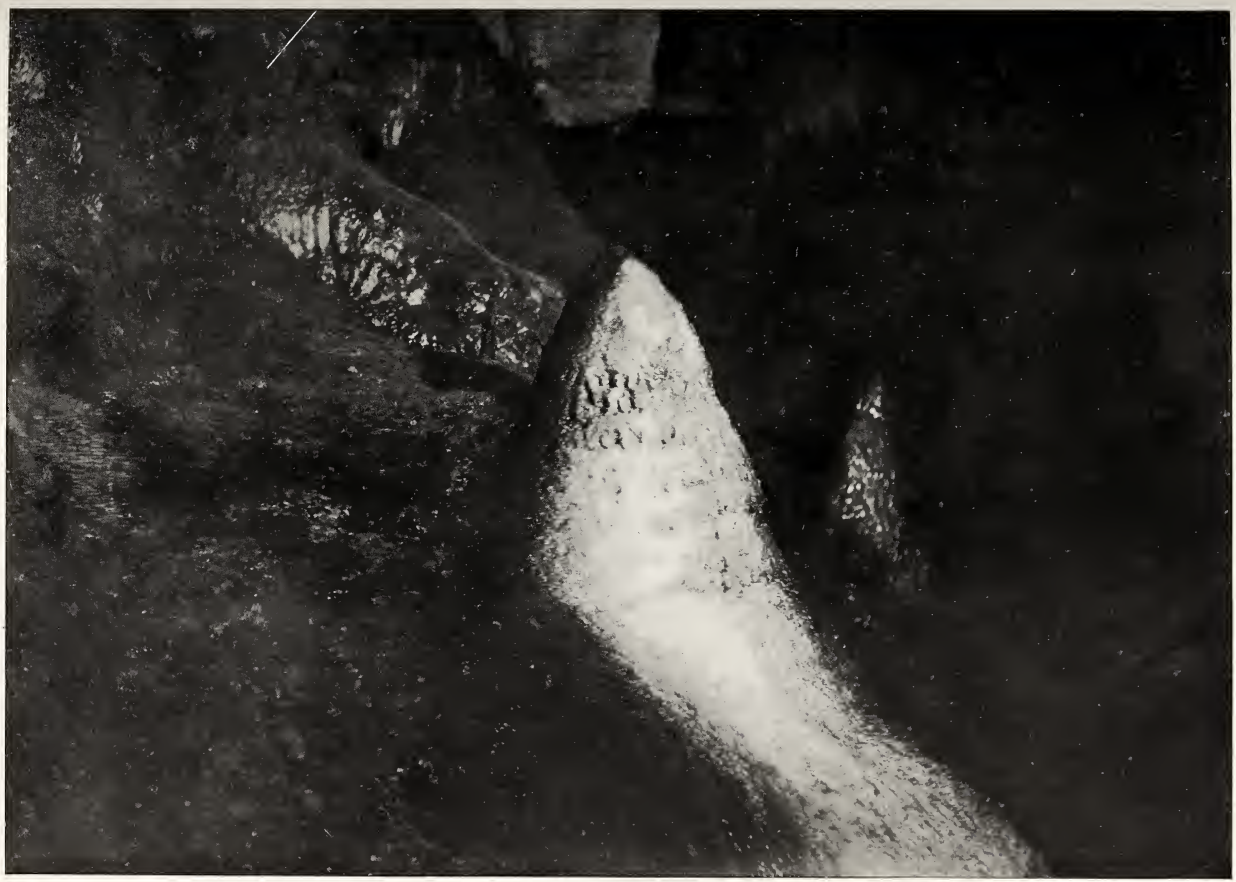
trance where it is drained off to the south along a joint. A second drain exists 150 feet beyond and carries some of the streams in times of high water. The drains unite as shown on the map on the preceding page, the stream finally disappearing through a crevice too small to enter and reaching the surface along the Cobleskill-Brayman contact line a short distance beyond the old cement quarry on the road to Braymanville. The drains can be penetrated by a person of average size who is willing to endure some discomfort. Both are narrow and the upper is full of water at all times. They are undoubtedly the latest passages developed in the cave.

The entrance is only one of several mouths which have at one time or another served to discharge water from the cavern, but the others are filled with clay and gravel beyond hope of clearing. One of these will be found in the face of the cliff in the upper Rondout beds, the passage leading to it forming a lower gallery known as the "Old Cave." For some 200 feet the floor of the main cave has fallen into this passage and the gap has been spanned with a wooden bridge.

Perhaps the most interesting part of the cavern is the inner end of the axial cavity and the branches reaching it. As has been stated the stream rises from a passage which lies below its surface. This is due to the fact that fragments fallen from the roof or walls and a quantity of gravel brought in through the branch caves have made a dam which reaches above the ceiling of the part now drowned. The "West Branch" comes in from the south and from a higher level; it is nearly filled with clay and broken blocks of limestone and ends abruptly at an impassable barricade of the latter. The other branch is called the "Winding Way," a name justified by its unusually tortuous course. From the main cave it runs north and ends in a small hole known as "Fat Man's Misery." This is seldom free of water. The passage beyond continues to the north for several hundred feet to "The Rotunda," a high domelike chamber appearing like a mighty gun barrel. It does not end here and is evidently passable for some distance further but is well filled with water.

There are a number of tufa deposits in the cavern but few in the form of stalactites and they can hardly be said to add any beauty to the place.

The stream is inhabited by the blind amphipod Crangonyx tenuis (Smith) which however is the only true cave form to be found. As in most of the caverns a few stray frogs and earth-



Howe's cave. "The Sentinels" — two pure white stalagmites overlooking the "Valley of Jehosaphat." View from top of "Rocky Mountains"

Howe's cave. "The Peacock's Feather" — a curious erosion form in the roof of the channel beyond "Cataract Hall"

Howe's cave. Passage at end of "Barytes cave" leading to an independent cavern in Rondout beds

HOWE'S CAVE
BEYOND THE END OF THE MAIN PASSAGE
Finis
Hidden Gate
Blind Passage
The Drowned Cave
The Winding Way
West Branch
Main Cave
N

worms are occasionally met with in the summer and around the bridge, railings and ladders, where the mycelia of various species of fungi grow, beetles, myriapods and isopods may be discovered but all seem to be surface species which have undergone no alteration in the new environment.

The cave beyond the point where it is drowned is undoubtedly several miles long. "Rock holes" were found north of the western turnpike between Little York and Carlisle village and three surface streams south of the turnpike between these places disappear in the rock. Every effort was made to penetrate to the cavern below but these attempts were not crowned with conspicuous success. Running water near the base of the Manlius was found in **Sellick's cave,** a deep fissure traversing both Coeymans and Manlius on the farm of Chester Ottman 1 mile southwest of Carlisle village, but the passage through which it flows is blocked off from the fissure by the rubbish which has fallen through and almost closed the entrance. Just north of Carlisle Center several small streams fall into rock holes and reach the Manlius limestone. One of these shafts was opened with some difficulty and a small cave was found below it. This, however, was perfectly dry and no outlet could be discovered. It was named **Cave Disappointment.** Another of these shafts is known as **McFail's cave.** It received its name from an unfortunate man who lost his life while exploring it more than half a century ago. We were unable to penetrate to the cavern below but Dr R. J. Roscoe who was a member of the original exploring party has informed me that this runs northeast and southwest through the "waterlime" (Manlius) carrying a stream running southwest.

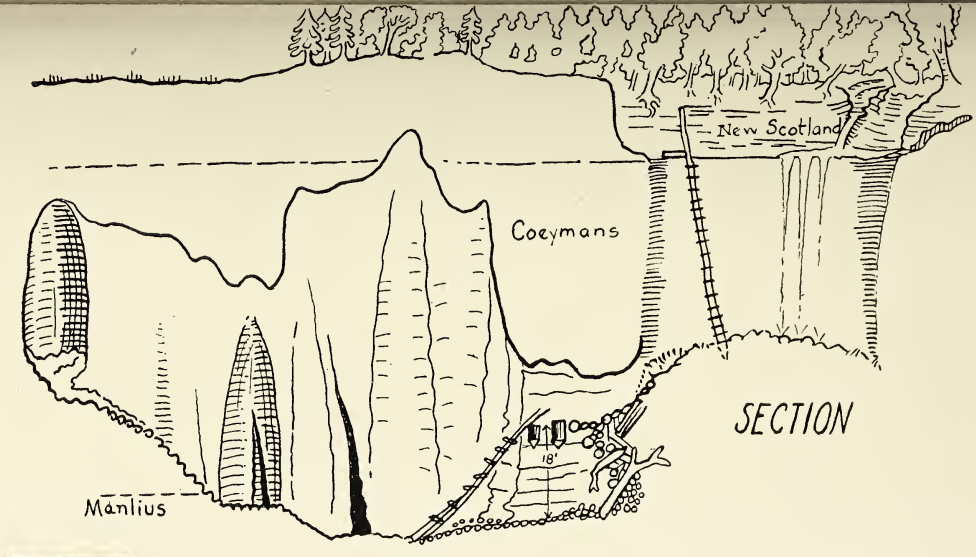
Beneath the entrance to Howe's cave was found an independent cavern in the upper Rondout beds which was explored for a distance of 1126 feet. It is excavated mostly along joint planes, is very narrow and contains several bodies of ponded water. Connection between this and Howe's cave has been established through the passage known as the "Barytes mine"[1] and clay washed in from the larger cavern has filled its lower end. It possibly originates in **Wolfert's cave,** a deep double shaft ⅓ mile due north of Howe's cave on the farm of Alonzo Wolfert, and a few rods east of the highway.

[1]Hovey, H. C. Celebrated American Caverns.

Plate 10

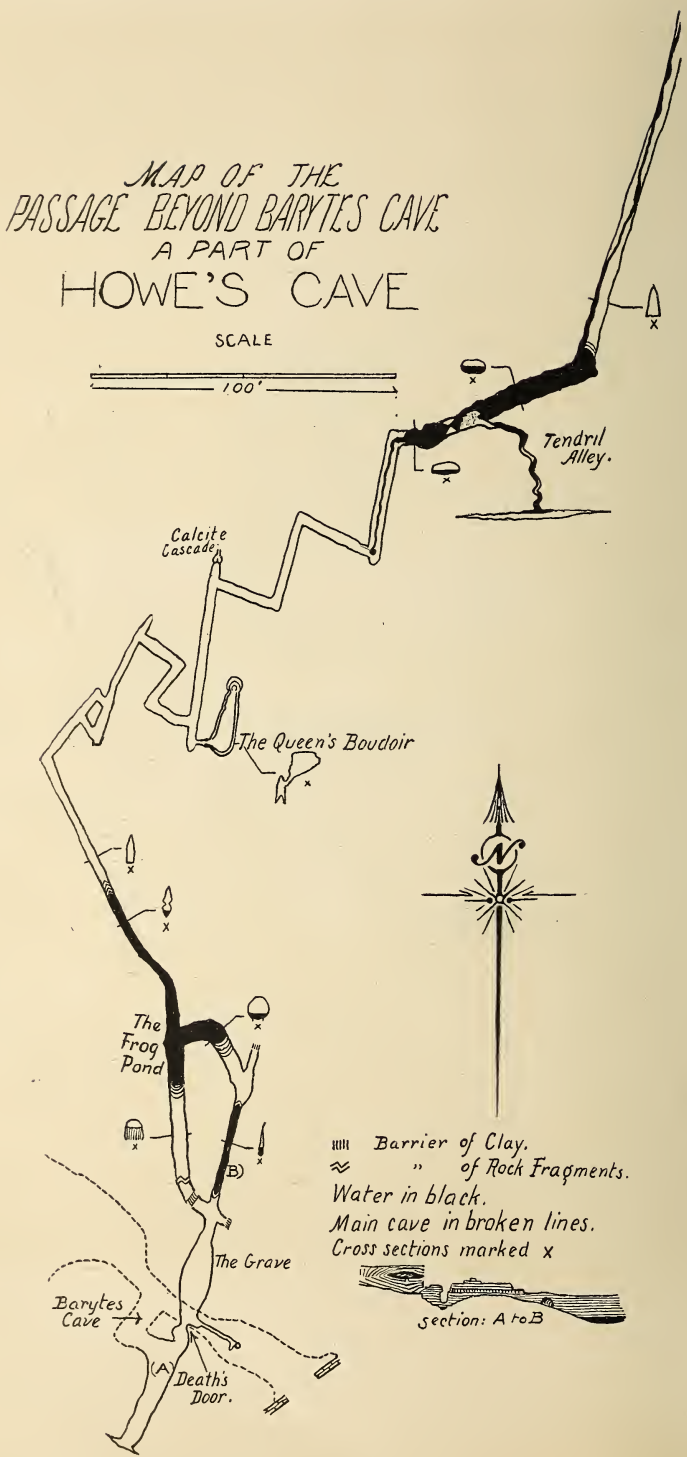

Sellick's cave. The entrance is a vertical drop of 34′.

"Cave Disappointment." The narrow crevice through which entrance was effected





CAVE DISAPPOINTMENT


MAP OF THE
PASSAGE BEYOND BARYTES CAVE
A PART OF
HOWE'S CAVE
SCALE
100'
Tendril Alley.
Calcite Cascade
The Queen's Boudoir
N
The Frog Pond
B
The Grave
Barytes Cave
A
Death's Door.
Barrier of Clay.
" of Rock Fragments.
Water in black.
Main cave in broken lines.
Cross sections marked x
section: A to B

Becker's spring; formed by a cavern stream forcing its way through glacial drift

Half a mile n. 10° w. of Wolfert's cave on the property of J. M. Collins is **Benson's cave.** It may be followed for 1040 feet, the accessible part being excavated almost wholly along deep vertical joints. There have been stalactitic decorations in one of the conical domes but they have been broken to pieces by collectors. The passage is simple and twice doubles on its course in a rather peculiar manner, one section extending for 609 feet almost directly against the dip.

**Richtmyer's cave,** ½ mile further north is entered from a pit in the Coeymans limestone. It consists of a medium-sized room and a widened joint running southeast (both in the Manlius) and may be followed for about 300 feet. This may be connected with Howe's cave.

**Jack Patrick's cave** is located near the head of a gorge which opens into the Cobleskill valley between Howes Cave and Central Bridge. It is excavated along joints in the Cobleskill and Rondout with some solution along the contact line. It can be penetrated for only a short distance and is doubtless a drain which draws off the water from a large cavern in the higher limestones. The stream issuing from it is fairly strong even in dry weather. The cave probably parallels Howe's cave and may reach beyond Grovernor Corners where a small underground stream is to be found in **Pigmy cave** on the property of William Passage between that place and Carlisle Center.

**Youngs's cave,** on the farm of Spencer Youngs ½ mile due west of Carlisle Center is excavated in the Becraft limestone and discharges a stream into the southern end of the trough at the opposite extremity of which are McFail's cave and Cave Disappointment. The roof has given way for most of its length but is intact for three or four hundred feet. Ponded water and a low ceiling prevent one from passing underground from one end to the other.

There is another subterranean waterway in the Becraft which deserves attention although all efforts to penetrate it failed. It extends from the depression on the farm of Leroy Lawyer 1¼ miles north of Russell lake, to Becker's pond, a spring 80 feet in diameter and 25 feet deep, a little more than ½ mile south of Shutts Corner. It receives also the drainage from a depression on the farms of William Brown and Chester Kniskern a mile and a half west of Carlisle Center and probably also a stream which falls into a fissure in the Becraft near the barn of David Chambers between Carlisle Center and Shutts Corner.

Map of
PIGMY CAVE
Scale
40'
N
Entrance
Communication with Surface
Stream
OPEN
Roof
Fallen
Roof
Fallen
Roof

Young's cave, in unprotected Becraft limestone. The fate of a cavern

## Section III

### Caverns of the Fox Creek valley

The valley of the Fox creek receives underground drainage from the region lying north of it. Cut nearly along the strike in its lower course, it offers conditions favorable for the excavation of a number of small caves but a large one is hardly to be looked for. Without exception the mouths of these were found to be choked by deposits of the cavern streams or buried by glacial material.

There is one on the Martin Spateholts farm at Shutter Corners, another near the head of the Louse kill, and a third farther down the same stream above the sawmill on ground owned by Wesley Wilbur.

**Ball's cave** is the only one of the group which is accessible. The entrance is a vertical shaft in the Coeymans limestone located on the north side of Barton hill, 3/5 mile southeast of the point where the road to Quaker Street crosses the county line. It is reached by a wood road from the house of Edwin Dietz and admits one to a cavern which, as far as can be seen, has been dissolved out of the basal Manlius beds.

A steep descent from the bottom of the shaft leads to a point in the cave about midway between the limits of exploration in either direction. At some seasons the whole cavern is full of water but usually the downstream (southwestern) half can be traversed without a boat. This part extends for 200 feet to a mass of fallen fragments which must be climbed in order to reach what has been spoken of in the meager literature of the cave, as its chief attraction, a large room named the "Rotunda" or "Amphitheater." Nothing remarkable was found in the chamber and published descriptions which have pictured it as "rich in stalactitic decorations" have been drawn from perfervid imaginings rather than from facts.

This room and the passages beyond it lie at a level higher than that of the principal channel which is buried by clay and fragments. The cave stream appears as a spring in the last chamber reached and disappears again almost immediately beneath a mass of limestone precipitated from the roof.

The upstream (northeastern) end of the cavern always contains water which in places is as much as 7 feet deep. The stream is retained as a series of pools behind natural dams of tufa formed apparently as deposits from flowing water. Three hundred and

SECTION
MAP OF
BALL'S CAVE
Entrance
Steep Descent
Fox Room
Dock
Dam 1
9 8 7 6 5 4 3 2
Square Room
Probable Course of Stream
Broken Room
Spring Room
Probable Course of Stream
Amphi-theatre
Scale
60'
NORTH

Plate 14

Ball's cave. Vertical entrance shaft

Ball's cave. Entrance to the "Broken Room"

Ball's cave. First tufa dam

thirty feet from the beginning of the water this end of the cave expands into a chamber at a higher level beyond which the passage is small and so filled with water and soft clayey mud that it is practically impassable.

## Section IV

### Caves of the Helderberg mountain

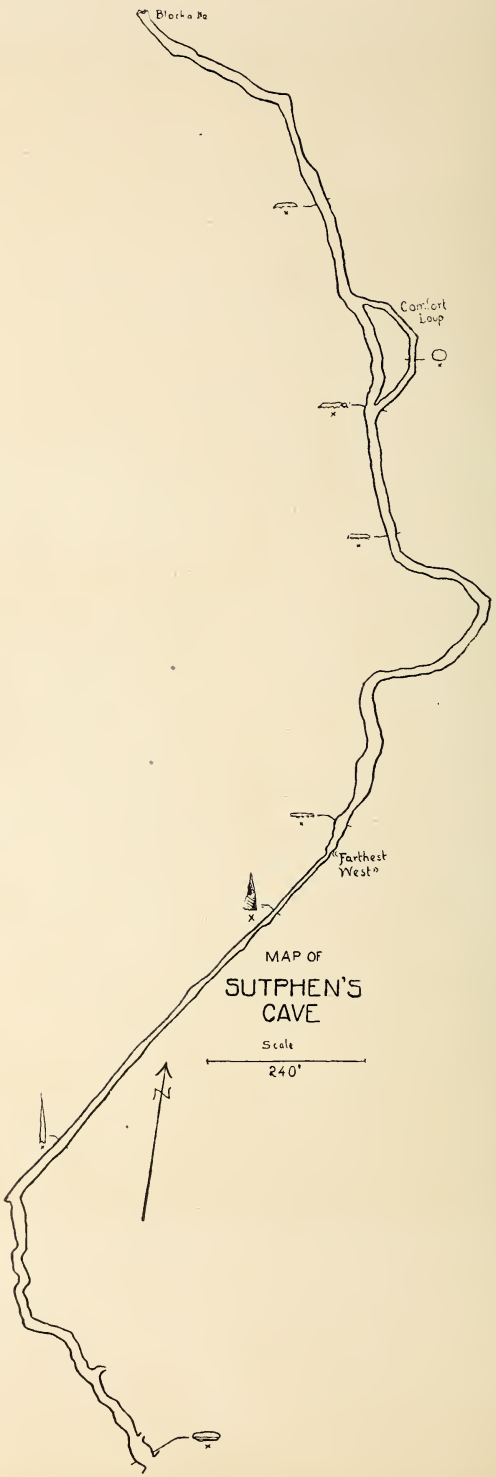
Several caverns exist at the base of the Manlius limestone between Altamont and New Salem but because of the limited area draining into them they have not developed to a size that renders them accessible, and only one was found large enough to enter. This is known as **Sutphen's** or **Thacher's cave** and is on the property of Hon. John Boyd Thacher of Albany. It is located at the base of the cliff beyond the alcove north of the Indian Ladder road and is most conveniently reached by crossing the fields back of the house occupied by Mr Albertus Hallenbeck or near the top of the "Ladder."

The passage for the first 530 feet is broad and low with pools of water at intervals. The general direction of this first section is n. 40° w. Then for 750 feet the cavern is a high narrow joint running n. 35° e. toward the face of the cliff. At the end of this section the incongruous legend "farthest west" has been painted upon the wall. The remainder of the cavern averages 2 feet in hight and 12 in width, extending irregularly to the northwest for 1603 feet, beyond which it is impossible to go. A small branch which leaves and returns to the main passage, something over 600 feet from the farther end is clear of clay and fragments and high enough to permit one to walk in a stooping position. For this reason it was named "Comfort Loop," the comfort being purely relative.

Thacher's cave probably receives its supply of water (which is intermittent) from the area surrounding a depression 1 mile northwest of its mouth.

**Wynn's cave** and **Livingston's cave** near High Point, south of Altamont are remnants of caverns whose streams were active before the cliff had retreated to its present line. The former extends for several rods, the latter is scarcely more than a room.

These caves are all in the Coeymans-Manlius series.


Blackberry
Comfort Loop
Farthest West
MAP OF
SUTPHEN'S CAVE
Scale
240'
N

The "Proscenium arch"—the limestone wall overhanging the entrance to Thacher's cave. Hight 105'. Cave entrance at the base and not shown in the view

Thacher's cave. One of the pools near the entrance

## Plate 19

Thacher's cave. The widened joint constituting the second section

## Section V

## Caves of the Oniskethau valley

Two caves are known to exist on the north side of this creek, one in the Manlius where that formation is brought to the surface in an anticlinal fold 1½ miles southwest of South Bethlehem, the other at Clarksville. The former was not visited.

The **Clarksville cave** in its lower course is nearly filled with gravel and for a long distance is inaccessible. A short section may be entered near the road running east and west through the village, and a short distance from the old hotel. It is called the "Little cave." A longer section, the "Big cave," is entered at the top of the hill north of the shorter part. The cave presents usually a smooth rounded arch in the harder beds, though in the thinner beds the floor is littered with fragments and presents much the appearance of a Manlius cavern. A stream flows through it at all seasons and empties into the Oniskethau creek south of the village. It is ponded in the larger section some rods from the entrance and it would be necessary to build a boat in the cave to cross the water. It is quite possible that this stream enters the rock opposite the church near Thompsons Lake, but this can not be determined without further exploration. The cavern is in the Onondaga limestone.

### INTERNATIONAL COMMITTEE ON GEOLOGICAL NOMENCLATURE

This is a committee organized by the joint action of the Geological Survey of Canada and the United States Geological Survey for the purpose of attaining a uniformity of nomenclature for the rock formations traversed by the international boundary and spreading thence north and south. During the past season the New York-Canada boundary was under special consideration by a subcommittee represented by Drs F. D. Adams and A. P. Coleman of Canada, Professors J. F. Kemp and C. H. Van Hise for the United States Geological Survey and Prof. H. P. Cushing for the New York Survey. This field conference involved the review of areas of crystalline rocks within the Adirondack region and north of the New York line. The results are believed to be entirely satisfactory to all interests concerned.

### INTERNATIONAL CONGRESS OF GEOLOGISTS

The convention of this international body representing the geologists of the world was held in September 1906, in the City of Mexico. As it was impracticable, because of more pressing engagements, for the State Geologist to be present this institution

was represented by Dr R. Ruedemann, one of the secretaries of the organization.

## PALEONTOLOGY

### Correlation studies

**Early Devonic of Gaspe.** In my report of last year mention was made of the comparative study of the Devonic faunas of New York with their manifestation in the regions northeastward to the Atlantic border. The treatment of this subject constitutes the matter for Museum memoir 9, the first volume of which is now all in type and the lithographic plates well forwarded. This volume will concern itself with accounts of the Devonic faunas of Gaspé and their relations to those of New York. The profusion and excellent preservation of the representatives of the New York faunas in that region has afforded important light on the proper grasp of the developments in New York. A conception of the fulness of the presentation of these faunas is conveyed by the fact that it has required about 50 quarto plates to represent these faunas adequately.

In 1900 I proposed definite stratigraphic terms for this Gaspé Devonic, grouping the divisions which had previously been made by Sir William Logan and to validate these terms it has been necessary to analyze their faunas in detail. This work pertaining to the eastern Devonic has proceeded with deliberation because of its wide scope. It will require some time yet to bring it to a conclusion and for this reason it has seemed well to establish some of the results attained in the course of the work by a preliminary account of some of the species, which has appeared in Museum bulletin 107.

**Paleozoic faunas of eastern Maine.** In order to facilitate the work referred to above, I commissioned Mr O. O. Nylander to make collections of Devonic and Siluric fossils from the region of Cobscook Bay, Me. His investigation, occupying a few weeks of the field season, resulted in acquisitions of very considerable interest both to the collections of the Museum and to the problems under investigation. The localities represented are on Moose island, Carlton island, and various points in the town of Perry. Fossils were found for the first time in the purple shales at Pembroke and considerable collections made from Siluric strata on the west side of the Pennomaquan river and other points in the town of Pembroke.

**Early Devonic strata at Lake Memphremagog.** An examination of the upturned and much cleaved and altered strata at the south end of Lake Memphremagog has brought out some facts which may serve to throw light on the character of the faunas. Near Knowl-

ton's Landing, Dr Ruedemann has recorded a section where about 100 feet of erect grit strata with Taonurus are both underlain and overlain by dark argillites. The former, on account of the presence of the Taonurus or "Cauda-galli fucoid" have been correlated as "Esopus grit" by the Canadian geologists. The argillites, however, both above and below these Taonurus grits, contain fossils; a Dalmanites nearer to the D. coxius of the Grande Grève limestone than any other that occurs to me and an Orthoceras with a well defined and peculiar surface which I have not seen in other species. There are traces also of other fossils. It seems hardly an accurate expression to correlate these beds with the Esopus grit of New York on the basis alone of the presence of Taonurus which is now recognized as of direct or indirect mechanical origin and occurs freely in sandy sediments of different ages. The fossils of the adjoining conformable shales will determine the age of this deposit. At Owl's Head fossils were obtained from the altered limestones; these are chiefly corals, though brachiopods are also present. The preservation is execrable but the corals, Favosites, Heliophyllum, Phillipsastrea and the brachiopods Atrypa reticularis, Spirifer like S. acuminatus and a large Rhynchonella, seem to entirely confirm the correlation by the Canadian geologists with the Onondaga limestone. The two sections referred to are several miles apart.

**The Rensselaer grit.** Eastern Rensselaer and northern Columbia counties are covered with a mantle of arenaceous deposits lying unconformably on the upfolded Cambric and Lower Siluric strata beneath. The character and distribution of this rock was clearly outlined by Lieutenant Mather in his report on the first geological district (1843) and its equivalence with the Shawangunk grit of Ulster and Orange counties suggested.

As the early geologists held the latter to be an eastern equivalent of the Oneida grit of central New York, the Rensselaer grit has consequently been assigned the same value in correlation. We owe to T. Nelson Dale of the United States Geological Survey an intimate knowledge of the stratigraphic relations of this terrane to the unconformable rocks beneath and also the conclusion that the upfolding of the lower and the upper terranes pertains to different dates, the former to the Taconic uplift and the latter to the Postdevonic or Carbonic uplift which also produced the more southerly synclinals now represented by Becraft mountain, Columbia co. Mr Dale has correlated the Rensselaer grit with the entire Oneida-

Medina sedimentation. The recent work of C. A. Hartnagel a published in these reports indicates conclusively that in the typica section the Oneida conglomerate is not a formational unit bu actually lies within the Medina sandstones, that further the Shawan gunk grit on stratigraphic evidence alone, is of an age much later than the Medina formation and being overlain conformably by rocks of Postsalina age is probably the eastern representative of the Salina deposition. The essential confirmation of the latter conclusion by the discovery of an eurypterid fauna in the Shawangunk grit is elsewhere referred to. Mr Hartnagel has pointed out the improbability of the Siluric age of the Rensselaer grit or of its equivalence with the Medina-Oneida sediments, his chief arguments being (1) the extensive gap by nondeposition between the eastern terminus of the Oneida conglomerate in Herkimer county and the Rensselaer grit plateau, (2) the long time interval that must be postulated to account for the Taconic folding and the erosion that preceded the deposition of the grit, (3) the gradual transgression northward of arenaceous sediments over the eroded folds, the Shawangunk grit being a more southerly and hence earlier representative of such transgression. The region has been carefully searched during the past season for some evidence of fossils which would throw definite light on the problem of the age of this Rensselaer grit, but though this evidence still fails and can not be explained by secondary changes of the rocks, the stratigraphic considerations indicate the propriety of assigning to this formation a distinctly later age.

No beds later than Trenton age have been observed near the edge of the plateau and there are apparently no outliers to bridge the gap between the late Siluric and early Devonic rocks of Becraft mountain, Mt Bob and the last outlier of the Rensselaer grit in the town of Austerlitz, Columbia co. This last outlier is of especial interest because it lies but 20 miles northeast of Becraft mountain and is situated a considerable distance south of the main mass of the Rensselaer grit plateau. For these reasons it was specially studied but found to be in no way lithologically different from the Rensselaer grit in Rensselaer county and containing the same alternations of grit with red and greenish slates.

From the presence of only the closing stage of the Upper Siluric at Becraft mountain and in the Helderbergs near Albany, (Countryman hill)— the two places where the deposits of the Siluro-Devonic basin of New York approach nearest to the Rensselaer

grit plateau — it may be properly inferred that the Upper Siluric sea of New York did not extend into the present area of the Rensselaer grit plateau at any time except possibly in the Manlius age. In regard to the latter, the problem is the same as in regard to the Helderberg limestones in general which are exposed at Becraft mountain and of which the Rensselaer grit might represent the littoral facies. In favor of this view it may be said that both rest on the same basis (Cambric and Lower Siluric slate) and that on account of the rising of the Taconic mountains in early Siluric time, there may have existed a littoral facies of the Helderberg rocks to the east. But this view is strongly opposed by the fact that the Helderberg rocks do not show any indications of approach to a littoral region at Becraft mountain, but retain the same lithologic characters that they possess over a vast area. There would hence have to be assumed an extremely abrupt and improbable change in facies in the short distance of 20 miles from Becraft mountain to the outlier at Austerlitz. An exception to this seems to be made by the Oriskany sandstone, Esopus grit and Schoharie grit which not only contain sand and grit at Becraft mountain and in the Helderbergs, but in some places as at Whiteport and Kingston, contain conglomerate beds. It is altogether probable that the material of these conglomerates was derived from the south and the Oriskany sandstone is too thin a layer (30 feet) at Becraft mountain, to be correlated with the thick mass of the Rensselaer grit (1400 feet). It is, however, possible that the Esopus and Schoharie grits which at Becraft mountain have a combined thickness of 300 feet and are similarly barren in fossils, once continued northeastward into the Rensselaer grit trough. Since they represent an invasion of the sea that came from the south and spread northward in the direction of the Rensselaer grit plateau, and the overlapping Rensselaer grit is clearly the product of an invading, not a receding sea, it is a question for consideration whether the Rensselaer grit was not deposited in a long narrow embayment extending northward from the Oriskany-Esopus-Schoharie grit sea of southern New York. But in this case also, there is still to be explained the extremely rapid change from the typical Esopus grit of Becraft mountain to the red and green slates and coarse grits of the Austerlitz outlier, and the fact that the Esopus grit is thicker southward (700 feet in Orange county), and thins out toward Becraft mountain. The regular succession of the various members of the Lower and Middle Devonic in Becraft mountain with the same lithologic

characters as in the Helderbergs and much farther west and south is undeniable evidence that the Helderberg sea extended farther east than the present Rensselaer plateau and with unchanged or but little changed conditions. In this connection it is further to be considered that the Rensselaer grit plateau has clearly its main extension in a north and south direction, (according to Dale, there is a further outlier in Vermont) and represents a deposit in a long submeridional Appalachian trough. Its pebbles of coarse and fine gneiss came from a short distance and the numerous Lower Cambric pebbles probably from places north of the plateau. It is therefore the deposit of an embayment which may have received its materials from the north. The entire absence of fossils in the nearby Becraft mountain formations is a further argument against correlation with the latter, as it indicates estuarine conditions greatly different from the marine conditions of the Helderbergian sea depositing the Becraft mountain rocks.

These indications of estuarine conditions in the Rensselaer basin, consisting in the alternation of red and other highly colored shales with coarse grits and conglomerate and the barrenness of the beds in fossils, suggest a possible identity with the Catskill beds which loom up across the Hudson, thousands of feet thick and only 30 miles away from the outlier of Austerlitz. There is no doubt that the deposits of the Catskill estuary must have extended to and beyond the Rensselaer grit plateau; the main extension of that estuary as already shown by the writer was in the same direction as the Rensselaer plateau. The thickness of the Rensselaer grit corresponds better with that of the Catskill beds than with any other, the lithologic characters are similar, and both have in common the barrenness in fossils.

From the location of the Rensselaer grit plateau relative to the Siluric and Devonic rocks of New York and its lithologic characters, the Rensselaer grit would be most naturally connected with one or another of the two Devonic phenomena referred to, viz, the Oriskany invasion or the Catskill embayment.

**Eurypterus fauna of the Shawangunk grit.** Reference has been made above to the discovery, after the determination of the age of the Shawangunk grit of Orange county as probably equivalent to the Salina of central New York, of beds bearing Eurypterus intercalated in these grits. In another place I have given a full account of the stratigraphy and character of this fauna and here briefly summarize the principal facts of this very noteworthy and

highly significant discovery. The Shawangunk grit throughout its extent along its western ridge from Ulster county into the Kittatinny mountains of New Jersey and on its eastern from Skunnemunk mountain, Orange co. to Green Pond, N. J., had never furnished fossils until the work of the past season brought them to light. In some of the Orange county exposures it has been found that above the basal conglomerate of the formation through the grit layers for a thickness of about 600 feet there are frequent repetitions of thin, black shale layers, inconstant in extent and in number along the outcrops and most of them bearing the remains of merostome crustaceans, of the genera Eurypterus, Pterygotus, Hughmilleria and their allies. The fauna must have been an extensive one as the remains are various and abundant but the preservation leaves much to be desired especially in the case of larger crustaceans whose surface has afforded opportunity for shearing and consequent deformation or destruction of the parts. Yet in some respects the preservation has been remarkably favorable for small individuals and these shales have afforded the most diminutive examples of these interesting creatures yet brought to light. The presence here of the genus Hughmilleria, heretofore known only in the Pittsford shale at the base of the Salina series in Monroe county, is sufficient evidence of the contemporary age of this arenaceous mass.

In themselves the fossils are extremely interesting affording some details of ontogeny not before recorded for these ancient Merostomes. It is entirely evident in the writer's opinion that these crustacean faunules running through the strata for so great a thickness indicate temporary and very changeable brackish water pools over the surface of a rapidly accumulating delta derived from the drainage of the high folded lands to the northeast, the deposit laid down in an embayment entirely separated from the salt pans and Dead Sea conditions of central and western New York by a barrier lying approximately in the present position of the Helderberg mountains.

**Utica shale at Otisville.** The Shawangunk grit at Otisville lies unconformably on the so called "Hudson River" shales and the exposures recently created at this spot have afforded some light on the proper correlation of the parts of this vast homogeneous formation. These rocks near Otisville have afforded a considerable number of graptolites and the brachiopod Schizocrania filosa. The leading species of graptolites are Climacograptus typicalis, C. bicornis and Diplograptus

quadrimucronatus, all characteristic of the Utica shale of the Mohawk valley.

The aggregation shows the extension of the Utica shale fauna, hitherto traced by its fossils only to the neighborhood of Albany, into this southern belt of the formation and close to the boundary of New Jersey, in which state the continuation of the same shale belt has thus far furnished only the Normanskill (middle Trenton) graptolite fauna.

## SPECIAL PROBLEMS

**Graptolites of New York.** In 1905, part 1 of a monograph of the graptolites of New York by Dr Ruedemann, Assistant Paleontologist, was issued. This work embraced the species of the earlier strata. The second part comprising species of the later Lower Siluric, Upper Siluric and Devonic has been in preparation for several years and is now completed.

These faunas contain considerably more than 100 species, mutations and varieties, all from the State of New York. The scope of the work has been extended as far as practicable to all the graptolite shales of the United States, for while through Hall's pioneer work in this field the graptolite shales of New York have furnished the standard for all the graptolite beds of America, it is desirable that the occasion of this revision of the New York faunas should be used to compare these with those of the continent and to determine as far as possible the paleogeographic distribution of the various graptolite zones. One of the most interesting of these extralimital faunas is the Normanskill (middle Trenton) fauna from Alabama. This has been found directly between Trenton limestones, thereby demonstrating the correctness of the conclusion arrived at before by indirect evidence that the Normanskill graptolite shale is of Trenton age.

This second part contains an introduction; chapters on the morphology of spines; on the disks in Climacograptus bicornis; on the vesicles upon the nemas in species of Diplograptus and Climacograptus which are found to be inflations of the outermost perisarcal layer, obviously serving to increase the buoyancy of the rhabdosomes, and on the so called axis or virgula of the Dicranograptidae which is found to be not homologous to that of the other Axonophora, but of different secondary origin. The composition of the successive faunal zones and their paleogeographic distribution are given, the careful comparison of the species with those of other countries allowing more correct correlations

han were formerly possible. It is found e.g. that both graptolites of the Clinton shale, Monograptus clintonensis and Retiolites venosus are identical with two graptolites (M. priodon and R. geinitzianus) that have a very wide distribution in Europe and characterize one of the many graptolite horizons of the European Upper Siluric. Thereby it becomes possible to correlate with precision the upper Clinton beds of New York with a definite European graptolite horizon.

**Genera of the Paleozoic corals.** On several occasions reference has been made to the study of the Paleozoic corals which was carried on during the later years of the life of Prof. James Hall and provisionally brought to a close not long after his death. The undertaking was one of broad scope and attended with many difficulties. So serious did the latter appear that it was deemed wise not to attempt the publication of the work in the form in which its author left it, but to insure its accuracy by placing it for revision in the hands of an expert student of the corals. My desire to bring about this revision has not been successful until this year when an arrangement was perfected with Dr T. Wayland Vaughan through which his services will be given to the work as he can command them. Dr Vaughan has been able to devote some time to this undertaking during the past season and will continue his efforts to unravel a very tangled and involved problem which has already cost a large expenditure of time and effort.

**Devonic crinoids of New York.** Sufficient progress has been made in the study of the crinoids to justify the expectation of early completion of the Camerate genera.

**Monograph of the Devonic fishes.** This work, referred to in my last report, is now in press.

**Mastodons.** In a previous report I entered into a detailed account of the discoveries of remains of mastodons in this State since the original excavation of such remains, a short distance below Albany, in 1705 [Report State Paleontologist 1903]. The following memoranda are here added to the record.

CHEMUNG COUNTY

**? 1799, 1855.** The paragraph which follows is from Dr W. M. Beauchamp's bulletin on Indian Place Names in New York [N. Y. State Mus. Bul. 108. 1907].

Chemung has various forms, as that of Skeemonk in 1777, and Shimango in 1779. In 1757 the French spoke of the "Loups of

Chaamonaque or Theoga," meaning the Delawares living at Tioga It was written Shamunk in 1767, but usually Chemung. The river and an Indian village bore this name, which meant *big horn.* The village was burned in 1779. Zeisberger has Wschummo for *horn,* and the locative may be added. Spafford said: "Chemung is said to mean *big horn,* or *great horn,* in the dialect of the Indian tribes that anciently possessed this country. And that a very large horn was found in the Tioga or Chemung river is well ascertained." This was a Delaware name, and the river has another of similar meaning. In Schoolcraft's larger work is a communication from Thomas Maxwell, who gave the usual definition and said that the name came from a large horn or tusk found in the river. Of course this must have been in colonial times to have originated the Delaware name. The early settlers found a similar horn in the stream in 1799. It was sent to England, and an eminent scientist called it the tusk of an elephant or some similar animal. In 1855 Mr Maxwell added:

One of much the same character was found on an island in the river below Elmira, a few weeks since, and it is now here. I have recently examined it. It is about 4 feet in length, of the crescent form, perhaps 3 to 4 inches in diameter. Capt. Eastman saw it yesterday and with others who have seen it pronounce it to be ivory, and a tusk of some large animal, probably now extinct. This is the third horn or tusk which has been found in the Chemung so that the name is likely to be perpetual.

ORANGE COUNTY

**1899.** Parts of a skeleton were exhumed near the village of Arden on lands of Mr E. H. Harriman. Efforts made to secure all the bones resulted in uncovering only a few portions of the scapula or pelvis, leg, ribs and two teeth. The soil was peat or vegetable mold.

CATTARAUGUS COUNTY

**1906.** Parts of a skeleton represented by 40 to 50 bones mostly vertebrae and foot bones were found in the banks of the State ditch along the Conewango creek close on the boundary between Cattaraugus and Chautauqua counties. The remains lay above a shelf of hard clay. Discovered and reported by C. N. Hoard and W. H. Hoard, Conewango valley, September 23, 1906.

WESTCHESTER COUNTY

**1906.** A tooth and some small fragments of bone were found on the property of W. H. Fish, Hartsdale.

**Fossil plants.** As opportunity has afforded, Mr David White has continued his investigations of the Devonic plants. He has given

special attention to the examination of the very large Upper Devonic "Lepidodendron" in the Museum — a specimen measuring 11 feet, 6 inches in length and with the root complete. As originally taken out this fine fossil had a length of 15 feet. Mr White has submitted the following note concerning this tree.

*Archaeosigillaria vanuxemi* Goepp. (sp.). This slab carries the basal portion of one of the earliest representatives of the great group of the Lepidophytes, a group of enormous extent and of treelike proportions in the older Coal Period (Carbonic), though survived now only by the relatively unimportant and humble Lycopodiales, including the club mosses ("ground pines" and "ground cedars") in the flora of today. The forerunners of the Lepidophytes in the Devonic, found but rarely and in a very fragmentary condition, were very much smaller than their Carbonic descendants from which they differed by certain systematic characters.

The stem here shown is extraordinary not only for its rarity, relatively fine preservation, and large size as compared with other Devonic plants, but also for the fact that it combines in one individual trunk some of the features which serve to characterize and differentiate several distinct later lepidophytic groups. It represents the type ancestral to these groups.

The base of the stem is truncated, probably as the result of decay of the main roots; but the small ribbonlike rootlets, articulated at typical stigmarian areolate scars, are still in evidence at the extreme butt. The latter is much dilated as the result of a very great thickening of the bark, and possibly by the development of some secondary (exogenous) wood in addition, so that the rows of leaf cushions are widely separated and frequently displaced in a way similar to that found in the base of some Carbonic sigillarian trunks and even in certain old trunks of Lepidodendron. Traces of leaf cushions are observable down to within 5 centimeters of the bottom of the specimen.

The stem rapidly contracts above the enlarged base and the number of leaf cushion rows, is, at the same time, greatly increased by the intercalation of new series. In this portion of the trunk the leaf cushions are sigillarian in form and they are placed in vertical rows, each row occupying the median area of a longitudinal rib, the cushions in the same row being separated by transverse grooves across the rib in an arrangement characteristic of the Favularian section of the Rhytidolepis group of the Carbonic Sigillariae.

Halfway up the trunk the leaf cushions are longitudinally more distant, while those near the borders of the specimen exhibit a rhomboidal form, which is clearly in a spiral arrangement, similar to that familiar in the Lepidodendra. Still higher they are narrowly rhomboidal, or obscurely fusiform, closely placed, slightly asymmetrical, and partially overlapped obliquely in the same vertical row. In this portion of the trunk the spiral arrangement is very sharp and the vertical costation is obscure except where exaggerated by lateral pressure along the median zone. In fact the form and arrangement of the cushions are essentially characteristic of the Carbonic Lepidodendrons. They are typical of the Devonic lepidophytic material described by authors as Lepidodendron though really differing from this genus by the characters of the leaf scar.

An interesting phase in the preservation of the trunk (seen at two thirds of its length) consists of the aspect of imbricated bracts or slivers. The latter correspond to the casts of the nerve sheaths passing outward and upward through the cortical tissues which in this region are partially macerated. The structure observed in this portion of the trunk is that sometimes seen also in partly decayed trunks of Lepidodendron, Bothrodendron and Asolanus, and represents the false genus, or condition of preservation, described as Knorria.

The leaf scars are well shown in the second and third quarters of the specimen. The scar, placed on the upper part of the cushion, is longitudinally oval and is provided with relatively long crescentic lateral cicatricules (parichnoi) that form a horseshoe beneath the nerve trace in the subepidermal impressions.

As in most of the other Devonic representatives of this group the leaves seem to have adhered to the bark, even after the branches and trunk had attained considerable size. Short, rather lax, slender, and inconspicuous examples, standing nearly at a right angle to the trunk, may be observed at various points along the periphery of the stem, especially on the left near the top. In form and habit they agree with the leaves of Lepidodendron and Bothrodendron.

As a whole, the trunk is seen to combine rootlet characters of Stigmaria; dilation and leaf cushion form and arrangement characteristic of Sigillaria in the lower part and of Lepidodendron in the upper portion; and a Knorria structure similar to that found in Lepidodendron, Bothrodendron, and the sigillarian Asolanus while the leaf scars are in character nearest to those of Cyclostigma (Bothrodendron), with which, as well as Lepidodendron, the leaves

hemselves agree. The specimen represents a Devonic type that vas ancestral to the Carbonic groups, Bothrodendreae, Lepidodendreae, and Sigillariae, mentioned above. Though combining and foreshadowing some of the distinctive characters of the later groups, it differs generically from all by the combination of these features, by the angle of the leaf spirals (phyllotaxy) and the details of the leaf scar itself.

*Locality.* Mouth of Grimes gully, 2 miles west of Naples, N. Y.

*Formation.* Hatch shale.

*Stage.* Upper Portage.

## III

## REPORT OF THE STATE BOTANIST

The State Botanist reports that the number of species of plants added to the flora of the State is 67. The number of species of which specimens have been added to the State herbarium is 155. Of these, 59 are species new to the herbarium, 95 not new. Of the former number 19 are considered new or undescribed species and descriptions of these will be found in his separate annual report. A list of the names of the added species is given under the title "Species added to the herbarium."

Though the season for the most part has been unfavorable to the development of fleshy fungi the investigation and collection of specimens of these interesting plants have been continued and 38 species of fungi have been added to our mycological flora. Of these 16 are new species. There have been added also 1 new species of panic grass and 2 new species of Crataegus or thorn bushes.

The trial of the edible quality of species of wild mushrooms has been continued as opportunity was found and has resulted in finding 11 species deemed worthy of addition to the list of edible fungi. This raises the list of New York edible species of mushrooms to 183. Of the 11 added species, 9 have been illustrated by colored figures of natural size on 6 octavo plates. Figures of the 2 remaining species, Russula earlei Pk. and Boletus rugosiceps Pk. have already been given; the former in Bulletin 67, plate N, figures 5–10, the latter in Bulletin 94, plate Q, figures 6–10.

The collection of specimens of species of Crataegus has been continued. Specimens have been procured in the northern, eastern,

central and southwestern parts of the State. The number of species added to the flora and represented by specimens in the herbarium is 8. Of these, 2 are new to science. Many specimens of this genus yet await identification.

About 20 species of trees are represented by botanical specimens not included in the foregoing enumeration. These were collected for the purpose of replacing those that were damaged or lost in the St Louis and Portland Expositions.

During the interval between the collecting seasons of 1905 and 1906 the annual report for 1905 was prepared, an additional table case of specimens of parasitic fungi was placed on exhibition and the contribution of the Osaka Mushroom Merchants Association, the receipt of which was acknowledged in the annual report for 1905, was prepared for exhibition and placed in the botanical exhibit room of the State Museum. A revision of the New York species of the two large and somewhat difficult genera, Russula and Hygrophorus, was made and in many cases more complete and satisfactory descriptions of the species have been written.

The assistant in botany has been chiefly occupied with office work. He has incorporated the collections of 1905 in their proper places, has disinfected and labeled the specimens, attended to the correspondence in the absence of the Botanist, identifying specimens sent for determination and giving information sought concerning them. He has prepared a card catalogue with descriptive references of the new species of fungi described by the Botanist.

## Species added to the herbarium

*New to the herbarium*

Allionia hirsuta *Pursh*
Amanitopsis pulverulenta *Pk.*
Ascochyta pisi *Lib.*
Aster arcifolius *Bu.*
A. elaeagnus *Bu.*
A. fragrans *Bu.*
A. multiformis *Bu.*
A. violaris *Bu.*
Boletus subpunctipes *Pk.*
Caryospora cariosa *Fairm.*
Collybia campanella *Pk.*
C. lacerata *Lasch.*
Cortinarius intrusus *Pk.*
C. validipes *Pk.*
Crataegus arcana *Beadle*
C. bissellii *Sarg.*
C. cognata *Sarg.*
C. deltoides *Ashe*
C. habereri *Sarg.*
C. noveboracensis *Sarg.*
C. scabrida *Sarg.*
C. tenella *Ashe*
Cynoglossum boreale *Fern.*
Didymium clavus (*A. & S.*) *Rabenh.*
Dryopteris pittsfordensis *Slosson*
Entoloma minus *Pk.*
Flammula expansa *Pk.*
Gaura coccinea *Pursh*
Hydnum luteopallidum *Schw.*
Hygrophorus burnhami *Pk.*
H. luridus *B. & C.*
Hypocrea pallida *E. & E.*
Inocybe pallidipes *E. & E.*
Lepiota asperula *Atk.*
L. eriophora *Pk.*
Leptoglossum fumosum *Pk.*
Linum medium (*Planch.*) *Britton*
Marasmius phyllophilus *Pk.*

Mycena albogrisea *Pk.*
Nicandra physaloides *Gaertn.*
Ohleria modesta *Fckl.*
Omphalia pusillissima *Pk.*
Panicum deminutivum *Pk.*
Peckiella hymenii *Pk.*
Phyllosticta ampelopsidis *E. & M.*
P. smilacis *E. & E.*
P. sphaeropsidea *E. & E.*
Pleurotus terrestris *Pk.*
Polyporus galactinus *Berk.*
Puccinia peckii (*DeT.*) *Kell.*
Russula foetentula *Pk.*
R. modesta *Pk.*
R. pectinatoides *Pk.*
R. vesca *Fr.*
Scleroderma tenerum *B. & C.*
Septoria lycopersici *Speg.*
Stecchcrinum adustulum *Banker*
Stemonitis smithii *Macb.*
Tricholoma hirtellum *Pk.*
Viola incognita *Brainerd*

*Not new to the herbarium*

Agastache scrophulariaefolia (*Willd.*)
Amanitopsis volvata (*Pk.*) *Sacc.*
Aquilegia canadensis *L.*
Arctium lappa *L.*
Asarum canadense *L.*
Aster camptilis *Bu.*
A. claytoni *Bu.*
A. concolor *L.*
Boletus auriporus *Pk.*
B. frostii *Russ.*
B. nigrellus *Pk.*
B. peckii *Frost*
B. rugosiceps *Pk.*
Bromus tectorum *L.*
Castanea dentata (*Marsh.*) *Borkh.*
Catastoma circumscissum (*B. & C.*)
Chrysomyxa pyrolae (*DC.*) *Rostr.*
Chrysopsis mariana *Nutt.*
Clavaria botrytoides *Pk.*
C. cristata *Pers.*
Clitocybe amethystina (*Bolt.*)
C. monadelpha *Morg.*
C. ochropurpurea *Berk.*
Clitopilus prunulus (*Scop.*) *Fr.*
Coreopsis rosea *Nutt.*
Cornus alternifolia *L. f.*
C. candidissima *Marsh.*
Crataegus caesariata *Sarg.*
C. coccinea *L.*
C. ferentaria *Sarg.*
C. illuminata *Sarg.*
C. intricata *Lange*
C. laneyi *Sarg.*
C. pedicellata *Sarg.*
C. pringlei *Sarg.*
C. punctata *Jacq.*
C. spissiflora *Sarg.*
C. tenuiloba *Sarg.*
Craterellus cantharellus (*Schw.*)
Cypripedium acaule *Ait.*
Daedalea quercina (*L.*) *Pers.*
Dasystoma virginica (*L.*) *Britt.*
Dryopteris boottii (*Tuck.*) *Und.*
D. cristata (*L.*) *Gray*
D. crist. clintoniana (*Eat.*)
D. simulata *Dav.*
Eleocharis inter. habereri *Fern.*
E. melanocarpa *Torr.*
Gentiana crinita *Froel.*
Hydnum aurantiacum *A. & S.*
H. fennicum (*Karst.*) *Sacc.*
H. imbricatum *L.*
H. repandum *L.*
H. vellereum *Pk.*
H. zonatum *Batsch*
Hypopitys lanuginosa (*Mx.*) *Nutt.*
Ilex vert. cyclophylla *Robins.*
Inocybe calamistrata *Fr.*
Irpex canescens *Fr.*
Lactarius ful. fumosus *Pk.*
L. pergamenus *Fr.*
L. piperatus *Fr.*
L. vellereus *Fr.*
L. volemus *Fr.*
Lespedeza angustifolia *Pursh*
L. hirta (*L.*) *Britt.*
L. virginica (*L.*)
Lobelia dortmanna *L.*
Lycopus sessilifolius *Gray*
Meibomia marilandica (*L.*) *Kuntze*
M. rigida (*Ell.*) *Kuntze*
Monarda punctata *L.*
Mycena galericulata (*Scop.*)
Physarum lateritium (*B. & R.*)
Polyporus schweinitzii *Fr.*
P. sulphureus (*Bull.*)
Polystichum acrostichoides (*Mx.*)
Polystictus simillimus *Pk.*
P. subsericeus *Pk.*
Populus balsamifera *L.*
Russula carlei *Pk.*
Sagina procumbens *L.*
Scirpus atro. pycnocephalus *Fern.*
S. cyp. pelius *Fern.*
Senecio obovatus *Muhl.*
Solidago tenuifolia *Pursh*
Sporobolus serotinus (*Torr.*) *Gray*
Stereum versicolor *Fr.*
Strobilomyces strobilaceus (*Scop.*)
Trillium erect. album *Pursh*
Tricholoma alboflavidum *Pk.*
T. nudum (*Bull.*) *Fr.*
Viburnum lentago *L.*
Viola blanda *Willd.*
V. cucullata *Ait.*
V. fimbriatula *Sm.*
Woodwardia areolata (*L.*) *Moore*

IV

## REPORT OF THE STATE ENTOMOLOGIST

The State Entomologist reports that the season of 1906 has been marked by relatively few extensive depredations by insects pests. This is particularly true of the forms affecting garden, vegetable and other common farm crops. A remarkable large South American moth (Thysania zenobia Cramer) was taken in Albany the last of September. This magnificient moth has a wing spread of about 5 inches and its occurrence in this city is undoubtedly due to its having been brought north with a boat load of bananas or other tropical fruit. This capture is an example of the way in which insects are distributed through commercial agencies, though in the present instance it happens to be a species which can not sustain itself in this latitude.

**Fruit tree insects.** The San José scale is still regarded as a serious pest of the horticulturist though the experience of recent years has demonstrated beyond question the practicability of keeping this insect in check by thorough and timely applications of a lime-sulfur wash. Our experiments conducted during a series of years show this insecticide to be fully as satisfactory as any other material which has been employed, despite the fact that a number of new preparations have been put on the market in recent years. These latter, though they possess certain very desirable qualities, have not been tested sufficiently so that they can be recommended without qualification.

We find the grape root worm still abundant in the Chautauqua region and the present indications are that some vineyards may be seriously injured by its depredations within a year or two. This insect, as experience has shown, is more or less local in its operations and general predictions regarding its work are in most cases rather hazardous.

**Shade tree problem.** This phase of practical entomology has made considerable demands upon our time in the last few years. This has been due in large part to extensive defoliations of street and park trees in many cities and villages of the State by the white marked tussock moth, a species which rarely occurs in destructive numbers outside of municipalities and villages, and one easily controlled by intelligent effort. The elm leaf beetle has been particularly destructive in the Hudson valley and has become established in cities and villages in other portions of the State. The work of these

leaf feeders and their allies has created a great demand for information along these lines. A number of popular articles have been sent to the local press in various parts of the State, urging the adoption of comprehensive measures for the protection of trees. It is gratifying to state that considerable interest has been aroused and most commendable efforts made to protect the trees. This plan, if carried out, provides for the protection of the trees from year to year — something which we have been advocating for some time, and it is hoped that cities and villages will adopt the measures recommended. A special bulletin, treating of the elm leaf beetle and white marked tussock moth and giving summary accounts of each, has been prepared and will be issued shortly. More extended accounts of these and other insect enemies of shade trees are given in our recent publication on *Insects Affecting Park and Woodland Trees* [N. Y. State Mus. mem. 8], a quarto work of two volumes comprising about 1000 pages, illustrated by 72 plates (20 colored), and over 200 text figures.

**Gipsy and brown tail moths.** These two dangerous insects, thoroughly and widely established in eastern New England, have been the objects of considerable attention here. The gipsy moth in particular is a most dangerous leaf feeder and has excited much interest. Owing to the fact that this latter species has been very destructive in eastern Massachusetts and is still extending its range, it was deemed wise to distribute in many sections of the State a warning placard briefly describing the insect and the associated brown tail moth. The latter displays a marked preference for fruit trees and is very annoying on account of the intense irritation produced by the urticating hairs of the caterpillar. The placard was supplemented by a bulletin [N. Y. State Mus. bul. 103] giving more detailed information concerning these pests, with the result that many specimens of various insects were sent to the office for determination. The newspapers of the State cooperated most efficiently in disseminating information relating to these dangerous forms.

It is gratifying to state that, so far as we have been able to discover, there is no ground for believing that either the gipsy moth or its destructive associate, the brown tail moth, has become established anywhere in New York State, though it would not be surprising were one or both of them to obtain a foothold in the near future. It is very important that our citizens should know about the gipsy moth in particular and be prepared to suppress the pest upon its first appearance.

**Aquatic insects.** The earlier investigations of this group have been continued. Dr James G. Needham has an extensive monograph on the stone flies (Plecoptera) nearly completed and this work will prove a valuable addition to our knowledge of a hitherto much neglected group. Dr Cornelius Betten, who has been giving special attention to the Caddis flies (Trichoptera) for the past five years, continued his studies last summer at Buffalo and Ogdensburg. These insects are an important element of fish food and, in addition, are of considerable local significance in the city of Buffalo. They breed in such large numbers in the rapids of the Niagara river that each summer the adults belonging to this group and the not distantly related May flies (Ephemeridae) swarm by millions in portions of the city near the river front. The insects are so abundant as to prohibit outdoor painting during certain portions of the season. These flies were one of the factors which led to the locating of the Pan-American Exposition some distance from their breeding places. Dr Betten has given particular attention to this local phase of the problem and he is now engaged in preparing an exhaustive account of this very interesting and in some respects important group.

**Gall midges.** These minute, inconspicuous insects, belonging to a family comprising a large number of species, have been subjects of careful and extensive investigations by the Entomologist and his assistants. Certain forms, like the Hessian fly and wheat midge, are of prime economic importance. The former is well known as an exceedingly destructive enemy of certain varieties of wheat, and in 1901 caused an estimated loss in New York State alone of $3,000,000. The wheat midge in earlier years was also very destructive to this important grain crop. During the last decade another member of this family, the violet gall midge, has become a dangerous enemy of the extensive violet-growing industry, which has its most important center at Rhinebeck, N. Y. The members of this group are better known because of the many remarkable vegetable deformities they produce, and the adult insects present some interesting morphological variations. The continued and thorough collecting during the summer has resulted in the accumulation of a large amount of material. A recent catalogue lists less than 150 species as being native to North America, whereas our recent work has resulted in finding in New York State alone probably over 400 species, including therein representatives of genera hitherto unrecognized in this country, and presumably of others unknown.

Mr J. R. Gillett, a medical student, was engaged during the entire summer in making some 2000 microscopic preparations of these insects. These large additions to our collection will result in important contributions to our knowledge of this hitherto relatively unknown group. The value of this work has been greatly increased by the enthusiastic and intelligent collecting of Assistant Entomologist Young and Assistant Nixon.

**Publications.** The Entomologist has contributed numerous economic articles to the agricultural and local press. The report of the office for 1904, owing to delays, did not appear till early in the present fiscal year, and that for 1905 was not issued until September, 1906. A special bulletin giving a summary account of the gipsy and brown tail moths [Mus. bul. 103] was issued in midsummer, and the first volume of *Insects Affecting Park and Woodland Trees* [Mus. mem. 8] appeared in February; the second volume of this work will appear without delay.

Another paper entitled *Diversities among New York Mosquitos* was reprinted from the Yearbook for 1904–5 of the American Mosquito Extermination Society.

**Collections.** Considerable additions have been made to the State collections aside from those secured in prosecuting the special investigations mentioned above. A fine collection of parasitic wasps (Chrysididae) was received from A. Mocsary, Budapest, and a valuable addition to the Tachina flies from Dr Mario Bezzi of Torino, Italy. Some desirable mosquitos from the south and southwestern part of this country, from Jamaica and the Philippine Islands were obtained through various correspondents of the office.

The special collections made by the members of the office staff in the Cecidomyiidae, mentioned above, have resulted in large additions to this group. The work upon the State collections has continued with unabated vigor and the general condition of the collections has been much improved, particularly in the families Ortalidae, Trypetidae, Dolichopodidae and Ephydridae. The representatives of the latter groups have been determined by the Assistant Entomologist. The midges (Chironomidae) have received considerable study at the hands of Assistant I. L. Nixon, who has also devoted much time to the general arrangement and classification of the Coleoptera.

## V

## REPORT ON THE ZOOLOGY SECTION

The Zoologist assumed his duties on May 21. He found the collections in a somewhat unsettled state, owing in part to the sudden termination, caused by death, of rearrangements undertaken by his predecessor, and in part to the crowded conditions in Geological Hall resulting from recent encroachments by other State departments. A careful study has been made of these collections, with a view particularly to their possibilities of development in the new building.

The mounted birds have received much attention in the past and are probably in as good shape as any part of the exhibit. A portion of the series which had been disarranged will soon be restored to order. This collection is now thoroughly card-catalogued, but it is unfortunate that the specimens belonging to the old State collection are mostly deficient in requisite data. The style of standard and label in use being unsuited to present needs, an effort is being made to devise a superior mount.

In response to public demand the foreign birds (mostly of the De Rham collection) have been taken from storage and returned to the cases. They will later be given a more satisfactory installation.

The study series of bird skins, inaugurated last year, is rapidly outgrowing the quarters assigned to it.

The representation of the New York avifauna has been increased during the year by 20 species and about 30 sexes or phases of plumage new to the collection, besides several New York specimens of species hitherto represented only by extralimital examples. After correcting some misidentifications in the old material, this leaves 34 species (8½ per cent) of the birds reported from our State unrepresented in the Museum, together with 9 species of the hypothetic list. [Since October 1st about half of these missing species have been obtained and will be reported upon next year.] The added material has been chiefly in the form of skins, to conform to present space limitations.

Four new cases of birds mounted by the Taxidermist have been installed in the exhibition hall. These contain family groups of little green heron (Ardea virescens), Clapper rail (Ral-

## Plate 20

RECENT BIRD GROUP

Green heron

Ardea virescens (Linné)

## Plate 21

RECENT BIRD GROUP

Clapper rail

Rallus crepitans (Gmelin)

## Plate 22

RECENT BIRD GROUP

Slate-colored junco

Junco hiemalis (Linné)

lus crepitans), slate-colored junco (Junco hiemalis) and Cedar waxwing (Ampelis cedrorum). The heron and rail groups are larger than those previously attempted and are displayed in "all-glass" cases, an experiment which is not proving wholly successful as the cases admit moisture.

It is to be regretted that the unique collection of mounted poultry was forced out of exhibition during the winter to accommodate the agricultural offices, as there is a constant demand from visitors to be shown the collection.

The monograph of the *Birds of New York* has progressed satisfactorily. During the past year a tabulation of all available information regarding the birds of the State has been completed. This includes the 22 books and local lists of New York birds which are especially noteworthy, as well as the reports from about 100 observers in the different counties of the State. This work which was regarded practically completed a year ago, it has been necessary to entirely review on account of the unreliability of some of the reports previously tabulated and the acquisition of new knowledge. These tables, it is believed, are now wholly reliable and furnish an exhaustive account of the distribution of the birds in all parts of the State. A study of the faunal areas of New York has been completed and maps prepared showing the distribution of the most interesting Boreal and Carolinian species. The descriptive text has been prepared for a large part of the water birds. At the rate the work is moving, the first half should be completed within the present year. Besides the paintings by Mr L. A. Fuertes, many photographs have been secured illustrating life histories or nesting habits and also some of the rare or unique specimens which have been taken in the State. That portion of the work, however, which has consumed the most time and yet makes the least showing is the sifting or investigation of reports of rare birds taken in the State. The number of New York species now reaches 400 with several reports still in doubt.

The collection of mounted *Mammals* stands essentially as when last reported. It is card-catalogued in the same manner as the birds. A few specimens have been replaced during the year by fresh mounts, and the group of red fox illustrated in last year's report has been placed on exhibition on the fourth floor, where it is now the center of attraction. Similar groups of other mammals are contemplated.

The exhibit of *Reptiles* and *Batrachians* has received little attention during the year. It consists largely of the handsome Ward casts, a series which it may be well to extend. It is desirable also to display a larger number of species mounted in spirits when these can be prepared and space is available.

The *Fish* series exhibited likewise consists largely of Ward casts. It is proposed to eventually remove these from the plaster panels and hang them directly against an appropriate background. Additional casts, if purchased, should therefore be unframed. The matter of supplying fishes mounted in an approved manner to replace our few and superannuated specimens has been taken up with an experienced man. Experiments are also being made with an advanced method of mounting the fishes now very unsatisfactorily displayed in cylindrical jars. No additions to the fish collection were made during the year.

The reptiles, batrachians and fishes are card-catalogued.

The exhibition collection of *Invertebrates,* with the exception of the Mollusca, needs to be much expanded, as the alcoholic mounts of arthropods, echinoderms, coelenterates and sponges hardly constitute a fair representation of our State fauna. Another season's collecting on the coast will help to remedy this. The State series of shells needs to be relabeled and rearranged according to the new classification of Pilsbry, Simpson and Dall, while the reinstallation of the general exhibit (Gould collection) attempted several years ago remains unfinished, there being a gap in the classification with certain families in storage. To complete this will require considerable labor, but as the shell collection is one of the largest and most popular displays it is desirable that it be undertaken soon.

Progress has been made in the preparation of a Monograph of the *New York Mollusca.* This field is a broad one and appeals to a considerable body of the scientific public but the plan to bring together the sum of our knowledge of these widespread and interesting animals involves laborious and patient work which may not have its fruitage for some years.

The synoptical collection commenced by the late Dr Paulmier has been withdrawn from exhibition, on account of its fragmentary appearance, until such time as it can be filled out and prepared for installation in the manner intended by its designer.

An incomplete card catalogue of invertebrates covers chiefly, though but partially, material of rather recent acquisition. This is being rapidly extended and expanded. It is hoped that by another

year the zoological collections of the Museum will be completely inventoried and classified in the most convenient and practical form.

For special study, preparatory to a report, the Zoologist has taken up the spiders, of which he has prepared a check list of 470 species (now increased to 489) recorded from the State or immediately surrounding territory. A large amount of material has been collected or received through voluntary helpers, and enlarged water-color sketches of fresh specimens have been made by a competent artist, before their colors were affected by the preserving fluids.

The sketches and notes made by Dr Paulmier for a monograph of the myriapods are being treasured until an opportunity offers for the completion of his work. The large collection of specimens of this difficult group has also been assembled preparatory to study.

A check list of the echinoderms of the State and adjacent waters is being drawn up, as these forms have been neglected in the State publications and an illustrated report upon them is desirable.

Among matters of general interest may be mentioned the unusual abundance of the huge polyzoan, Pectinatella magnifica, in some of our streams this fall. As this raises important questions of its sanitary effect on drinking water and ice, it is hoped to investigate these growths in the field another year.

A driven well at Olean has furnished specimens of the blind cave shrimp, Crangonyx tenuis, apparently from a gravel stratum between 20 and 30 feet underground. The species has been previously obtained from Howe's cave.

Other unusual records are a "black woodchuck" from Fayetteville agreeing exactly with De Kay's description [N. Y. State Nat. Hist., Mammals, p. 69, "No. 2"] and from a point near De Kay's locality; a Florida "chameleon" captured alive in an Albany express office; and a southern spider, Heteropoda venatoria, also caught in Albany.

## VI

## REPORT ON THE ARCHEOLOGY SECTION

Field work in archeology for the season of 1906 began on May 1. A month's time was expended in making preliminary examinations of various sites of prehistoric and recent aboriginal occupation in the counties of Ontario, Livingston, Monroe, Genesee, Erie, Cattaraugus and Chautauqua. With the exception of the region west

of a meridian line through Chautauqua lake, most of the described territory has been the field of archeologic research for many years and the State Museum archeological collections have representative specimens from it. Western Chautauqua, however, is a practically unexplored region and presents an exceptionally inviting field for investigation, being the borderland between the territory of the tribes of Iroquoian stock and the culture area of that mysterious people for the sake of convenience termed "mound builders." An examination of this region revealed a surprising number of sites that proved to be rich in relics of old Erie occupations, and in view of the fact that the State Museum had few or no relics of the Eries, and, indeed, as very little was known of them, one of these sites was chosen as the field for the season's operations and a leasehold was obtained.

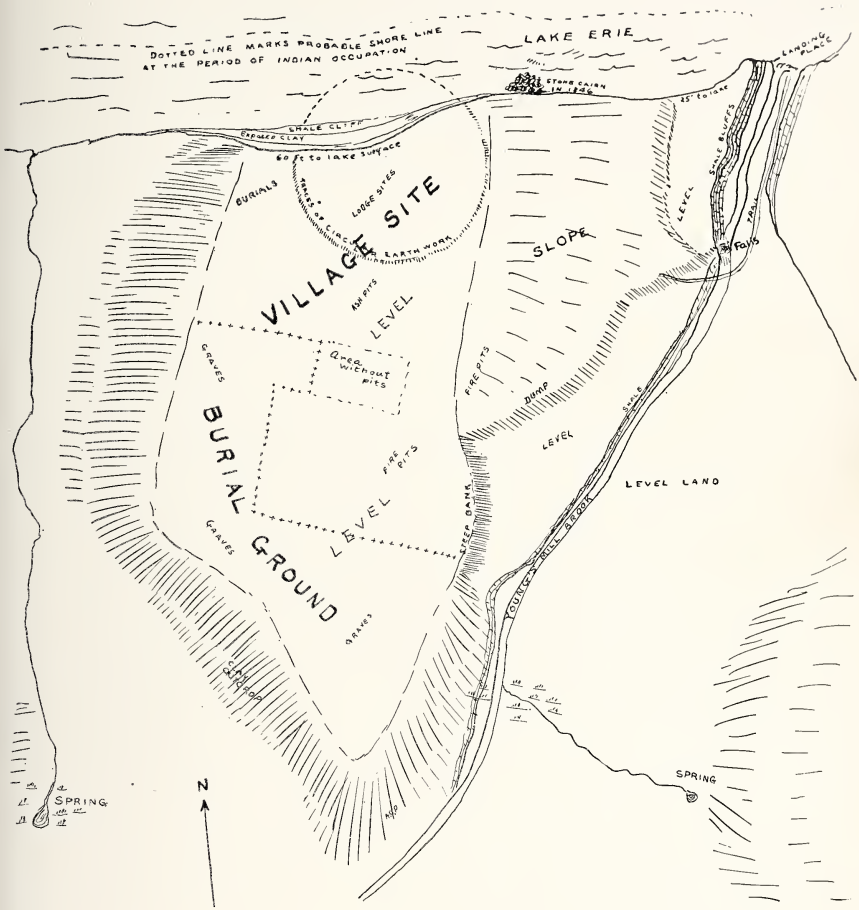
## Ripley site

This site is situated on the Young farm in lot 27, Ripley, Chautauqua co. It covers an elevation locally known as "Dewey knoll" situated on the bluffs of Lake Erie. On the east a stream has cut through the shale and eaten down the bluffs to the lake level so that a landing is easily effected from the water. This landing is one of the few between Barcelona harbor and the mouth of Twenty-mile creek in Pennsylvania, where there is easy access to the land on the bluffs above. The stream has cut the east side of the knoll so that for several hundred feet south from the lake the bank rises steep and in places almost sheer from the creek bed. The place is one, therefore, naturally adapted for a fortified refuge and must have been an attractive spot for the aborigines who built upon it a circular earthwork and a village and who found in the loose sand a most suitable place for the burial of their dead.

Excavations were commenced on June 1 and carried on until October 1. Parallel and adjacent trenches 16 feet wide were staked and the excavations run as far as indications of occupancy extended. In this manner every cubic inch of soil covered by the trenches and exhibiting signs of disturbance by human hands was examined and the numerous relics left by the former occupants were discovered. The site was divided in two sections, the village and the burial.

**The burial section.** An examination of 100 graves disclosed that all bodies had been buried in a flexed position, that is, on one side with the knees drawn well up toward the chin with one hand placed under or near the head, in fact such a position as would

## Plate 23




Map of Dewey's knoll on the William Young farm, Ripley, Chautauqua co.; the site of an ancient Erie Indian fort, village and burial ground

be assumed in sleeping. The head was placed toward no particular cardinal point although in the majority of cases the face was turned toward the east or west and rarely to the south. The majority of skeletons were those of mature adults although there were a few infants and young adults.

Field measurements of the bones indicate that the race was one of medium hight, 5 feet, 7 or 8 inches, perhaps being the average. A few skeletons were found that approached 6 feet. That the race was stocky is shown by the heavy development of muscular ridges, especially in the case of males whose bones were large.

The loose sand affording good drainage preserved the bones when they were not buried directly upon the clay stratum, but in either case by the shifting of the sand or through some other agency, most of the skulls were broken or crushed while other bones were in a much better state of preservation. Some of the complete skulls obtained are of exceptional interest. In form, all are either dolichocephalic or subdolichocephalic, none being of the brachycephalic type common to the regions of the "mound builder" culture 100 miles west. A large percentage of skulls from Erie sites, 30 miles east are characterized by aveolar prognathism, but among the 100 from the Ripley site, only two were found with this development. The *os incae* was observed in a few cases and also instances of wormian bones in pairs. In one skull, the *os japonicum,* that is the lower portion of a malar bone when divided by a suture, was noted. The skulls are mostly of a high type, the average capacity being 1587 cubic centimeters for males and 1440 for females. The average cephalic index would be perhaps 74.5, and the nasal index 47. A careful study of all the morphological characteristics will be made in the laboratory and reported in another place and may slightly modify the averages here given. In a few cases humeri were observed in which the olecranon cavity was perforated. In two instances an examination of the femur revealed the processes termed the third trochanter and hypotrochanteric fossa.

With the exception of two cases of ankylosis, no pathological conditions were noted. There are a number of bones, however, that indicate the repair of a breakage.

Only in a few cases were possible clues to the cause of death discovered. In several skeletons triangular arrowheads were found between the vertebrae and in other parts of the osseous structure. A remarkable form of ankylosis was observed in the case of an aged male whose entire spine had become cemented into one solid

bone. One low type female skull marked by prognathism and wormian bones has the frontal bone crushed, depressed and a perforation filled by osseous matter.

The graves were from 12 inches to 70 inches below the surface of the ground, but eliminating these extremes, 42 inches would be the average. The graves seem to have been lined with bark which in some instances was charred owing to the custom of building a fire in the grave to drive out the dampness and "warm the bed" in which the sleeper must rest so long. In other Erie graves elsewhere fire pits are almost without exception found in the top soil above. These are the remains of the ceremonial watch and feast fires that were customarily burned for 10 days. Here, however, only one out of 10 graves had the watch fire pit above. Perhaps 50 years of plowing had obliterated the shallow pits. In some places the burials were crowded together, some almost intruding on others.

The most valuable and interesting objects found by the expedition were discovered in the graves and include terra cotta vessels of various forms and ornamentation, pipes of the local clay or of stone, objects of shell, bone, chipped flint, polished stones, celts, bar celts and other articles. In several graves small pieces of iron were found, indicating European contact. Two graves yielded complete outfits for the manufacture of chipped flints, the stone hammers, anvils, flakers and pitching tools being together in one spot as if originally inclosed in a bag which afterward decayed. Where copper ornaments had been used the flesh, garment, or fabric in immediate contact with the copper or brass was preserved by the copper salts which were freed by natural agencies or by the acids formed by decomposition. In graves where copper was present, human flesh, skin, nails, hair and bones and animal skins, bark, wood, fabrics, vegetable matter, etc. were preserved by the copper. In one instance a lower arm incased by copper bands, each finger also being covered by a wide copper ring of native make, was almost entirely preserved by the copper salts. Upon exposure the flesh fell apart in strips baring the green copper-stained bone. The hair preserved by the copper is fine and black and the finger nails small and shapely.

The pottery vessels from the graves exhibit a wide range of forms, the old Iroquoian square top with raised corners, the southern cord-racked, and the pitcher-nosed being among the rarer forms. At least 20 pots are in absolutely perfect condition, 20 more have small breaks and perhaps 30 more are badly crushed, although

some may be restored. Because of the many unique features, the collection of pots may be regarded as the most remarkable ever taken from a single site in New York State.

Among the interesting products of the aboriginal Erie potter are six terra cotta pipes each differing in form from the other. Especially beautiful is a pipe having a bowl shaped like a human head with a delicately molded face on either side. Four carved stone pipes of unique forms were taken from the burials. The material of which they are made is foreign to the locality and seems to be trans-Mississippian. In the upper stratum of the soil above the ash pits, three other stone pipes were found, one a crude imitation in the local shale of the beak or claw pipe, and the other two, pipe bowls of the Wisconsin form.

A large number of polished, picked and rough edged stone celts were found, some of which are rare forms in New York.

Shell articles were not common, but one necklace of discoidal beads having two shell gorgets and a long pendant was found about the neck of an aged female. Flint objects were commonly found in graves especially those of males and include spears, knives, arrowheads of the triangular form, blank blades and chips. Black and red pigments were sometimes found in little deposits near the skulls.

**Pits in village site.** Fifty ash and refuse pits were opened in the village section of the site and yielded quantities of relics. The pits here were from 2 to 5 feet deep and in general had diameters equal to depths. The ash and carbonaceous matter in the pits, as is the case in all ash pits wherever found, preserved the bone and antler objects of which large numbers were found. Of the bone articles many beautiful ones were discovered, among which may be mentioned awls, beads, needles, shuttles, markers, balls, hooks, pendants, tubes and various objects the use of which is conjectural. The antler implements include spades, hoes, picks, punches, pitching tools, awls, flakers, pendants, chisels and scrapers. There were also scrapers made of beaver teeth and several kinds of perforated animal teeth found.

Stone objects were numerous, all the common types being represented.

Several pottery cups and thousands of pot fragments were taken from the pits. One sherd is particularly interesting from the fact that it is decorated with two parallel bands of brown on a background of orange. Whether this is an intentional decoration or an accident of baking is difficult to determine but if the color decora-

tion was purposely made it represents a development hitherto unknown in New York Indian pottery.

A few shell beads of native handiwork found in the pits are of the ordinary Iroquoian type.

Great quantities of animal bones, split and cracked for the marrow, were found in nearly all the ash pits. Of the animal bones identified the following is a list: beaver, bear, buffalo, elk, deer, raccoon, rabbit, woodchuck, skunk, fisher, squirrel, wildcat, porcupine, turtle, sturgeon, catfish, perch, billfish, mullet and pike.

Vegetable matter preserved by carbonization includes corn, nuts of various kinds, wood, grass, reeds and a section of a hollow pipe stem.

The thousands of specimens taken from the Ripley site form a most valuable accession to the Museum and represent the first successful effort to obtain a collection wholly by the research method, and by this method only may every scientific requirement be satisfied. Accurate and painstaking notes were made and scores of maps, diagrams, drawings and photographs were made to supplement the written descriptions. Every specimen was numbered in the field and a full description of the spot in which it was found, with all the circumstances, was filled in on a data slip. Every ash pit and grave may be mathematically charted on a map of the site made by a careful survey. Every important specimen was photographed exactly as found and all skeletons were carefully exposed and photographed before a bone was moved.

The rapidity with which the objects were found made it impossible to make a complete study in the field, but a full report of the important scientific results of the expedition will be embodied in a report to be published at a later date.

**Archeological collections acquired by purchase.** Since the last report three large collections of archeological material have been acquired. The first was obtained from Joseph E. Mattern of West Rush. It is especially valuable for the polished slate articles it contains as well as for the splendid series of stone and bone objects representative of the Genesee valley.

A collection of prehistoric Onondaga relics, a collection of relics from Algonkin fishing camps and a collection of objects similar to those of Eskimoan culture, from Jefferson county were purchased from Dr R. W. Amidon of Chaumont. These collections are most valuable for the bone objects of an ancient occupation, which they contain.

A collection of New York relics was also obtained from William A. Spear of North East, Pa. This comprises a large number of beautifully polished celts, slate gorgets, and highly polished articles of oolitic limestone. One of the notable specimens is a war club of curly maple which was found on the battlefield at Herkimer in 1791. It is one of the finest war clubs in the Museum. Another unique specimen in this collection is a wine press of stone, ingeniously wrought, found at Ripley.

During the early part of the year and up to June the Archeologist made several trips to the different Indian reservations and purchased a number of objects of ethnologic importance. These objects are the same in design and pattern as those of like character used two centuries ago and nearly all were found in actual use, a fact which illustrates the tenacity with which the Iroquois cling to their own culture.

The relics purchased include carved baby boards, ceremonial masks, wooden bowls, wooden ladles and spoons, ceremonial tom-toms, rattles, fans, baskets, sticks and poles, beaded blankets, strips, baby wrappings, leggings and skirts, silver brooches, earrings, dress ornaments and one silver crown. This crown or hat band is one of the largest made by the Iroquois and the last treasured insignia of the Tonawanda sachems.

**Tall Peter's crown.** Tall Peter the elder was one of the early chiefs of the Seneca-Iroquois.

In the memorable year, 1776, Noh-ka-ga-ah of the Turtle clan, or Tall Peter, as the white people afterward called him, was born in a bark lodge on the banks of the Cattaraugus, near Lake Erie. His mother's father had been a war chief, and he therefore was heir to the office. When he reached maturity the women nominated him and the warriors elected him war chief of the Senecas. It was then that his grandmother placed upon his head the crown which he afterward wore on all ceremonial occasions.

Ever since the advent of the white man up to within 25 years the democratic Iroquois have worn silver crowns and decorations. Money to them was an incomprehensible commodity; wampum was their medium of exchange. But to the savage everything had utility, so the New York savages hammered their silver into symbolic brooches and crowns.

With the increased influx of money and the depreciation of wampum a man's wealth was determined by the amount of silver he could fasten upon his buckskins, and it is a tradition that Tall Peter

could cover his broadcloth costume with brooches so thickly that he looked as if covered with the scales of a fish. Above this glittering suit, resting upon his raven locks was his crown, its curiously graven lines symbolizing his office.

Although still smarting under the effects of Sullivan's campaign, when the War of 1812 broke out the New York Indians offered their services to the United States. Some enlisted in the regular army, but most of them, many women, too, fought as allies. Tall Peter, being a war captain, donned his crown and led his company against the British. His shining crown made him the mark of hostile bullets, but he believed it a charm, for he emerged from the war without a scratch. He was discharged from the army in Buffalo.

Some of his compatriots had rather strange names and the roster of Indian veterans of the War of 1812 brings to light such names as Old Fish Hook, Tall Chief, Straight Back, George Washington, Corn Planter, Red Jacket, One Hundred, Two Guns, Twenty Canoes, Heap of Dogs and Devil's Ram Rod.

## VII

## PUBLICATIONS

A list of the scientific publications issued during the year 1905–6 with those now in press and treatises ready for printing is attached hereto. The publications issued are 15 in number on a variety of topics covering the whole range of our scientific activity. They embrace 2188 pages of text, 249 plates and 7 colored maps.

The labor of preparing this matter, verifying, editing and correcting is onerous and exacting. Taken together it excellently indicates the activity and diligence of the staff of this division.

### Annual report

1 2d Report of the Director, State Geologist and Paleontologist for the fiscal year ending September 30, 1905. 102p.

*Contents:*

Pit 4, trench 3, Ripley. Looking directly down into the grave. The bones had almost entirely crumbled, a part of the skull and a portion of the femur only remaining. With the skeleton was a pottery vessel.

## Plate 25

Grave pit 9, trench 3, Ripley. This grave contained the crumbling skeleton of an adult male. With the skeleton at the place indicated by the photograph was found a pipe of a most peculiar form [*see* pl. 33, fig. 1].

## Plate 26

Grave pit 44, Ripley. This grave was 49″ below the surface, the dimensions of the excavation being 5′ 6″ x 6′. It contained the remains of an adult male of mature years. The face of the skull was turned toward the west and the top of the head to the south. The skeleton lay on its left side. Above the skull in the position indicated by the photograph was a most unusual pipe molded from the local clay [*see* pl. 33, fig. 2]. Janus-like, this pipe has a face on either side and is one of the finest representations of the human face seen on any Iroquoian pottery. Above the skull were the inferior and superior maxillae of a young Ursus americanus, probably all that remains of a bear skin head or shoulder robe. There was much charred wood in the bottom of the grave. The bones of the skeleton were badly decayed but were removed. The skull was in a very poor condition and of little value. The hight of the individual, judging by the measurements of the bones, would approximate 5′ 7″.

## Plate 27

Pit 62 at 33′ in trench 10 contained the molar teeth of a child of 12 years. The excavation was probably a grave although no other osseous matter beyond the teeth was found. In the grave were two pottery vessels as shown in the photograph. One of the vessels is of an unusual form and contains a large quantity of charred tobacco ashes and the bowl of a terra cotta pipe. Ripley, N. Y.

## Plate 28

Grave pit 92, Ripley, at 84 feet in trench 10 was 3′ 4″ deep. It contained the decayed bones of an adult male of mature years. The spinal column was in one solid piece, the result of ankylosis. With the skeleton at the places indicated by the photograph were a double edged celt, a perfect pottery vessel, typically Erian, and a stone effigy pipe, representing some mythical animal [*see* pl. 33, fig. 3].

## Plate 29

Grave pit 96 at Ripley contained the skeleton of an aged female, the lower right arm of which was almost entirely preserved by the copper salts formed from the heavy copper arm bands and finger rings. Two infants' skeletons were found at her side and the skeleton of a headless male, near which was found one of the rarest of implements, a bar celt. Ten pottery vessels were buried in this family grave.

Plate 30

Necklace of shell disks found about the neck of a female skeleton, grave pit 133, trench 18, at 20′ on the west side. Ripley, N. Y. Restrung bead for bead as found.

Plate 31

1

2

3

1 Terra cotta vessel from pit 92
2 Pottery vessel from pit 4, trench 3
3 Pot from grave pit 104
All from Ripley

## Plate 32

1

2

3

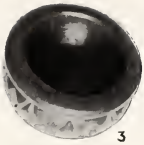
1 Pot with an extended nose like a pitcher found in grave pit 69 at 20′ in trench 12. This is one of the unique pieces from the Ripley site.
2 Pottery vessel 1 from pit 62. This pot is typical of the Ripley site.
3 Pottery vessel 2 from pit 62, Ripley. It was this pot that contained the tobacco ash and pipe. The rim ornament on the pot is unusual.

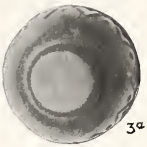
Plate 33

1 Terra cotta pipe from pit 9, trench 3. This pipe is unique in that it has a nipple over which a stem is designed to fit. In the ordinary pipe bowl the stem is inserted.
2 Terra cotta pipe from grave pit 44
3 Effigy pipe from grave 92
4 Double edged celt from grave 92
All from Ripley

## Plate 34













Polished stone objects from the William A. Spear collection:
1 Sharply beveled celt from vicinity of Findley lake
2 Highly polished war club head of marble
3 Polished cup of oolitic limestone. 3*a* view from bottom
4 Pipe bowl of oolitic limestone, 3 views
5 Small pestle or plummet
6–8 Gorgets from Findley lake

Plate 35

Implements of walrus ivory and bone from the R. W. Amidon collection, Jefferson county, N. Y.

Plate 36

Implements of bone and Ivory from Jefferson county. Many of the specimens in the R. W. Amidon collection, from which these objects are selected, show a marked similarity to those of the Eskimo.


Stone press for expressing juice from fruits and berries. This unique specimen is from the William A. Spear collection and was found at Ripley.

## Plate 38

HERON FEATHER FANS

Used in the ceremonies of the Seneca Order of the Eagle, a native Indian fraternity of great antiquity. These fans belonged to Gaioyade the chanter of the Eagles, and a member of the Heron clan. Heron feather fans must always have six feathers but a fan of eagle feathers may have only four. A picture accompanying these specimens illustrated the use of the fans and rattles in the lodge ceremonies of the Eagles.

Obtained at Newton, Cattaraugus Reservation, near Lawtons Station, N. Y. March 30, 1906

## Plate 39

Modern form of the old style Seneca headdress or Gus-to-weh.

This ceremonial headpiece was used by Chief Sai-no-wa, Inclined Post, in the Great Feather dance, in which ceremony he was one of the two chanters of the ritual. The chief, although he weighs 320 pounds, is an athlete of local fame, being an expert lacrosse player. He holds the unique record of having at the Pan-American Exposition caught a ball at the goal which he was guarding and throwing it across the field into the goal opposite. The admiring tribesmen of Sainowa say the big chief has big medicine.

Plate 40

Tall Peter's silver crown, the last treasured crown of the Tonawanda sachems.

## Memoirs

2 No. 8 Insects Affecting Park and Woodland Trees. By E. P. Felt. v. 1, 460p. 48pl.

*Contents:*



## Bulletins

### *Geology*

3 No. 95 Geology of the Northern Adirondack Region. By H. P. Cushing. 188p. 15pl. 3 maps.

*Contents:*



4 No. 96 Geology of the Paradox Lake Quadrangle. By I. H. Ogilvie. 54p. 17pl. map.

*Contents:*

*Economic geology*

5 No. 100 Fire Tests of Some New York Building Stones. By W. E. McCourt. 40p. 26pl.

*Contents:*



6 No. 102 Mining and Quarry Industry of New York. 2d Report. By D. H. Newland. 162p.

*Contents:*



*Mineralogy*

7 No. 98 Contributions from the Mineralogic Laboratory. By H. P. Whitlock. 38p. 7pl.

*Contents:*

*Paleontology*

8 No. 92 Guide to the Geology and Paleontology of the Schoharie Region. By A. W. Grabau. 316p. 24pl. map.

*Contents:*



9 No. 90 Cephalopoda of the Beekmantown and Chazy Formations of Champlain Basin. By Rudolph Ruedemann. 226p. 38pl.

*Contents:*



10 No. 99 Geology of the Buffalo Quadrangle. By D. D. Luther. 32p. map.

*Contents:*



11 No. 101 Geology of the Penn Yan-Hammondsport Quadrangles. By D. D. Luther. 28p. map.

*Contents:*

*Entomology*

12 No. 97 Report of the State Entomologist for the fiscal year ending September 30, 1904. 246p. 19pl.

*Contents:*



13 No. 103 Gipsy and Brown Tail Moths. By E. P. Felt. 44p. 10pl.

*Contents:*



14 No. 104 21st Report of the State Entomologist for the fiscal year ending September 30, 1905. 144p. 10pl.

*Contents:*

*Botany*

15 No. 105 Report of the State Botanist for the fiscal year ending September 30, 1905. 108p. 12pl.

*Contents:*



## Geological maps

16 Buffalo quadrangle
17 Penn Yan-Hammondsport quadrangles
18 Paradox Lake quadrangle
19 Portion of towns of Plattsburg and Peru, Clinton co.
20 Portion of towns of Chazy and Champlain, Clinton co.
21 Schoharie and Cobleskill valleys

IN PRESS

## Memoirs

22 Insects Affecting Park and Woodland Trees. v. 2
23 Early Devonic of Eastern North America
24 Devonic Fishes of the New York Formations

## Bulletins

*Geology and paleontology*

25 Geological Papers
26 Glacial Waters in the Lake Erie Basin
27 Drumlins of Central Western New York
28 Geology of the Long Lake Quadrangle
29 Geology of the Rochester and Ontario Beach Quadrangles

*Entomology*

30 White Marked Tussock Moth and Elm Leaf Beetle

*Archeology*

31 Aboriginal Place Names of New York
32 Civil, Religious and Mourning Councils and Ceremonies of Adoption

PREPARED

## Memoirs

Graptolites of New York. Pt 2, Graptolites of the Higher Beds

## Bulletins

*Geology and palcontology*

Later Glacial Waters in Central New York
Geology of the Morrisville Quadrangle

IN PREPARATION

## Bulletins

*Geology and palcontology*

Geology of the Theresa Quadrangle
Geology of the Highlands of the Hudson
Moraines of Western New York
Devonic Crinoids of New York
Devonic Plants of New York
Geology of the Auburn Quadrangle
Geology of the Portage-Nunda Quadrangles
Geology of the Genoa Quadrangle
Geology of the Geneva-Ovid Quadrangles
Geology of the Phelps Quadrangle
Geology of the Syracuse Quadrangle
Geology of Valcour Island
Geology of the Cazenovia Quadrangle

*Entomology*

Report of the State Entomologist for the fiscal year ending September 30, 1906
Monograph on Stone Flies
Monograph on Caddis Flies

*Botany*

Annual Report of the State Botanist for the fiscal year ending September 30, 1906

## VIII

## STAFF OF THE SCIENCE DIVISION AND STATE MUSEUM

The members of the staff, permanent and temporary, of this division as at present constituted are:

### ADMINISTRATION

John M. Clarke, *Director*
Jacob Van Deloo, *Director's clerk*

### GEOLOGY AND PALEONTOLOGY

John M. Clarke, *State Geologist and Paleontologist*
David H. Newland, *Assistant State Geologist*
Rudolf Ruedemann Ph.D., *Assistant State Paleontologist*
C. A. Hartnagel B.S., *Assistant in Economic Geology*
D. Dana Luther, *Field Geologist*
Herbert P. Whitlock C.E., *Mineralogist*
George S. Barkentin, *Draftsman*
William S. Barkentin, *Lithographer*
Joseph Morje, *First clerk*
H. C. Wardell, *Preparator*
C. A. Munger, *Stenographer*
George W. V. Spellacy, *Clerk*
Martin Sheehy, *Machinist*

### Temporary assistants

*Precambric geology*

Prof. H. P. Cushing, Adelbert College
Dr C. P. Berkey, Columbia University

*Stratigraphic geology*

Prof. T. C. Hopkins, Syracuse University
H. O. Whitnall, Colgate University
G. H. Hudson, Plattsburg State Normal School

*Geographic geology*

Prof. Herman L. Fairchild, Rochester University
Prof. J. B. Woodworth, Harvard University
Prof. A. P. Brigham, Colgate University

*Cave exploration*

John H. Cook, Albany
Harry Cook, Albany
John F. Loughran, Kingston

*Paleontology*

Dr C. R. Eastman, Harvard University
David White, United States Geological Survey
Dr T. Wayland Vaughan, United States Geological Survey
Edwin Kirk, Columbia University
Olof O. Nylander, Caribou, Me.

**BOTANY**

Charles H. Peck M.A., *State Botanist*
Stewart H. Burnham, *Assistant,* Glens Falls.

**ENTOMOLOGY**

Ephraim P. Felt B.S. D.Sc., *State Entomologist*
D. B. Young, *Assistant State Entomologist*
I. L. Nixon, *Assistant*
Anna M. Tolhurst, *Stenographer*
Howard C. Bain, *Page*

**Temporary assistants**

Dr James G. Needham, Lake Forest College
Cornelius Betten, Lake Forest College
John R. Gillett, Albany

**ZOOLOGY**

George H. Chadwick, *Zoologist*
George L. Richard, *Taxidermist*

**Temporary assistants**

E. Howard Eaton, Canandaigua
Dr E. J. Letson, Buffalo

**ARCHEOLOGY**

William M. Beauchamp S.T.D., *Archeologist*

**Temporary assistant**

Arthur C. Parker, Gowanda

**Maintenance.** The provision made by the Legislature of 1906 for the maintenance of the scientific work in all its branches and for the payment of all permanent and temporary services was $44,240.

# IX

## ACCESSIONS

### GEOLOGY

### Donation

**Cole, Howard J.** New York city. Series of samples showing character and depth of clays, sands and bed rock encountered in excavating for the foundation of the John G. Myers Co. building, Albany ..... 8

Samples of materials encountered in excavating for the foundation of the Trinity Annex building, New York city ..... 5

**Lynch, Daniel.** Minerva. Serpentine marble, polished, 4" by 6" ... 1

### Collection

**Assistant State Geologist.** Zinc ore, Saratoga Springs ..... 1

Zinc ore, Edwards, St Lawrence county ..... 5

Iron ores and associated rocks from Adirondack districts, as follows:

Benson Mines, St Lawrence county ..... 25

Jayville, St Lawrence county ..... 4

Clifton, St Lawrence county ..... 12

Fort Ann, Washington county ..... 10

Hammondville, Essex county ..... 33

Crown Point, Essex county ..... 3

Ticonderoga, Essex county ..... 3

Lake Sanford, Essex county ..... 12

Dannemora, Clinton county ..... 3

Arnold Hill, Clinton county ..... 20

**Assistant in Economic Geology.** Clinton iron ore and associated rocks as follows:

Ontario, Wayne county ..... 6

Sterling Station, Cayuga county ..... 6

Verona, Oneida county ..... 3

Clinton, Oneida county (lower oolitic bed) ..... 1

Clinton, Oneida county (upper oolitic bed) ..... 10

Clinton, Oneida county ("red flux" bed) ..... 3

Clinton iron ore from base of upper Clinton sandstone, Henderson, Herkimer county ..... 3

Clinton ferruginous sandstone, south of Frankfort, Herkimer county ..... 6

Clinton upper sandstone, south of Mohawk, Herkimer county ... 1

Peridotite dike in Devonic rocks at Glenwood, Tompkins county .. 3

Arsenopyrite (mispickel) Carmel, Putnam county ..... 3

"Hudson River shale," specimen of core from elevator shaft at depth of 128 feet below Pearl street curb, John G. Myers Co. building, Albany, N. Y ..... 1

**Total** ..... 191

PALEONTOLOGY

## Donation

**Hartnagel, C. A.** Albany. Guelph fossils from near Rochester.... 47
**Drevermann,** *Dr* **Fr.** Frankfurt, Germany. Fossils mostly Middle Devonic from Germany..... 195
**Derby, O. A. & Clarke, J. M.** Fossils including 120 types collected by Morgan expeditions in the Amazonas, Brazil..... 335

## Exchange

**Barroubio, Jean Miguel.** France. Fossils from various formations and localities in France..... 60

## Purchase

**Copi,** *Dr* **Fr.** Modena, France. Fossils from various formations in Sweden, England, Bohemia and France..... 30
**Krantz,** *Dr* **F.** Bonn, Germany. Trilobites from various formations in Prussia, Norway, Bohemia and Russia; fossils from upper Carbonic, Grundy county, Illinois..... 73
**Ward's Natural Science Establishment.** Rochester, N. Y. Trilobites from Ohio, South Dakota, Ontario, Can..... 5
**Alden, H. J.** Cambridge, Mass. Fossil fish (Dinichthys pustulosus Eastman) from Oneonta sandstone, Delhi, N. Y.. 1

## Collection

**Assistant State Paleontologist.** Devonic fossils from vicinity of Lake Memphremagog, Canada..... 230
**Assistant State Paleontologist & Wardell, H. C.** Crustaceans from base of the Salina, "Spring House," near Pittsford, N. Y..... 275
**Field Geologist.** Portage and Genesee fossils from Tompkins county..... 40
**Hartnagel, C. A.** Fossils from various formations..... 418
**Wardell, H. C.** Graptolites from Clinton beds, Genesee gorge, Rochester..... 30
Crustaceans from Bertie waterlime, Jerusalem Hill, Herkimer county..... 43
Crustaceans from Shawangunk grit, Otisville, Orange county..... 200
Fossils from the Helderbergian, Salisbury's quarry, North Litchfield, Herkimer county..... 125
Fossils from Rochester shale, Barge canal excavation, near Gates, Monroe county, N. Y..... 30
**Nylander, O. O.** Lower Devonic fossils from Washington county, Me..... 900

Total ..... 3037

MINERALOGY

## Donation

**Hodge,** *Capt.* **R. S.** Antwerp. Goethite, Antwerp ..... 1
**Cumings, W. L.** South Bethlehem, Pa. Pyroxene, Mineville ..... 1
**Hartnagel, C. A.** Albany. Celestite and calcite, Rochester ..... 1
**Hindshaw, H. H.** Albany. Tourmalin in oligoclase, Crown Point .. 2
Turgite, El Noel, Spain ..... 1
**Wardell, H. C.** Albany. Pyrite (nodules), Waterford ..... 3
**Wolf, William.** Waterford. Pyrite crystallized), Waterford ..... 1
**Wait, C.** Crown Point. Apatite (eupychroite), Crown Point ..... 7
**Van Deloo, J.** Albany. Calcite, Rossie ..... 1
Garnet (crystals), North Adams, Mass ..... 10
**Snyder, Grant.** Otisville, N. Y. Quartz, Otisville ..... 4
**Woodworth,** *Mrs* **J. L.** Albany. Orthoclase and fluorite, Victor, Col. 1

## Exchange

**Cumings, W. L.** South Bethlehem, Pa. Zircon in oligoclase, Mineville ..... 40

## Purchase

**Hodge,** *Capt.* **R. S.** Antwerp, N. Y. Millerite and garnierite, Antwerp ..... 2
Millerite, Antwerp ..... 23
Stilpnomelane (chalcodite), Antwerp ..... 20
Hematite (mammillary), Antwerp ..... 2
Hematite (specular), Antwerp ..... 25
Ankerite and dolomite, Antwerp ..... 21
Quartz and hematite, Antwerp ..... 9
Pyrite on dolomite, Antwerp ..... 2
Goethite on quartz and dolomite, Antwerp ..... 8
Dolomite (large crystals), Antwerp ..... 1
Calcite and siderite, Antwerp ..... 1

## Collection

**State Geologist.** Calcite, Gaspé, Can ..... 140
**Assistant State Geologist.** Zircon in oligoclase, Mineville ..... 5
Calcite, Arnold Hill ..... 1
**Mineralogist.** Albany. Tourmalin in quartz, Fort Ann ..... 1
Tourmalin, Fort Ann ..... 7
Orthoclase and quartz (perthite), Fort Ann ..... 1
Pyrite (nodules), Waterford ..... 4
Pyrite (dendritic), Waterford ..... 5
Aragonite on shale, Waterford ..... 1
Serpentine on shale, Waterford ..... 1
Orthoclase in quartz, Crown Point Center ..... 3
Orthoclase and oligoclase, Crown Point Center ..... 1

| | |
|---|---|
| Orthoclase and epidote, Crown Point Center | 1 |
| Orthoclase phenocrysts in quartz, Crown Point Center | 3 |
| Pegmatite crystallization showing structure (large), Crown Point Center | 1 |
| Calcite, Crown Point | 25 |
| Rutile in quartz, West Pawlet, Vt | 1 |
| Quartz, West Pawlet, Vt | 30 |
| Graphite in serpentine, Columbia Graphite Mine, Crown Point | 2 |
| Graphite in feldspar, Columbia Graphite Mine, Crown Point | 5 |
| Graphite in calcite, Columbia Graphite Mine, Crown Point | 1 |
| Graphite, Columbia Graphite Mine, Crown Point | 2 |
| Serpentine, Columbia Graphite Mine, Crown Point | 1 |
| Chondrodite in serpentine, Columbia Graphite Mine, Crown Point | 1 |
| Serpentine pseudomorph after chondrodite, Columbia Graphite Mine, Crown Point | 1 |
| Calcite, Crown Point Graphite Mine, Paradox | 7 |
| —— & Hartnagel, C. A. Brookite in calcite, Indian Ladder | 2 |
| Epsomite, Indian Ladder | 1 |
| Calcite and quartz, Indian Ladder | 20 |
| Total | 465 |

## ENTOMOLOGY

### Donation

*Hymenoptera*

**Woodworth, J. B.** Bembex pallidipicta Sm., cocoons, Sept. 11. Fort Edward, N. Y.

**Russell,** *Miss* **S. J.** Blue Point, L. I., N. Y. Cratotechus sp., adults, Aug. 20

**Burnham, S. H.** Albany, N. Y. Aulax glechomae Htg., galls on Glechoma hederacea Linn., June 20; Neuroterus batatus Finch, oak potato gall, gall on white oak, Sept. 15. Southeast of Easton, N. Y.

**Lutz, F. E.** Cold Spring Harbor, L. I., N. Y. Andricus lana Fitch, oak wool gall; A. petiolicola Bass., oak leaf stalk gall; A. seminator Harr., wool sower; A. singularis Bass., oak leaf apple; Amphibolips confluentus Harr., large oak apple; A. ilicifoliae Bass., black scrub oak gall, June 4

**Meays, Barton C.** Baldwinsville, N. Y. Kaliosysphinga ulmi Sund., elm leaf miner, larva on Camperdown or weeping elm, June 10

*Coleoptera*

**VanDuzee, E. P.** Buffalo, N. Y. Tomicus balsameus Lec., balsam bark borer, adult, June 22

**Huested, P. L.** Blauvelt, N. Y. Phymatodes amoenus Say, grapevine Phymatodes on grapevine, Mar. 19

**Posson, Chauncey.** Albany, N. Y. Hadrobregmus errans Melsh., adult on pine, Sept. 10

**Fredrick, George L.** Albany, N. Y. Dytiscus harrisii Kirby, margined water beetle, adult, Nov. 29

*Diptera*

**Stuart, C. W.** Newark, N. Y. Rhagoletis pomonella Walsh, apple maggot, larvae on apple, Sept. 5

**Eldredge, C. E.** Leon, N. Y. Scenopinus fenestralis Linn., carpet fly, larva, May 2

**Ludlow, C. S.** Washington, D. C. Anopheles maculipennis Meig., malarial mosquito, male and female; Culex microannulatus Theo., adults (male and female); C. gelidus Theo., adults (female); S. arnesii Ludlw., adults (male and female); Finlaya poicilia Theo., female; Myzomyia thorntonii Ludlw., adult (female, cotype) July 14

**Pettis, C. R.** Saranac Junction, N.Y. Anopheles punctipennis Say, Apr. 17

**Weeks, H. C.** Bayside, L. I., N. Y. Culex sollicitans Walk., salt marsh mosquito, Aug. 13; Paul Smith's, N.Y. Culiseta absobrinus Felt, larvae; Eucorethra underwoodi Undw., giant mosquito, larvae, Aug. 2

**Ashworth, J. H.** Edinburgh, Scotland. Culex pipiens Linn., house mosquito, larvae and pupae and adults, Dec. 13

**Needham, J. G.** Ithaca, N. Y. C. restuans Theo., white spotted mosquito, adult, Sept. 12. Lake Michigan.

**Grabham, M.** Jamaica, W. I. C. hassardii Gbhm., adults and larvae; Stegomyia mediovittata Coq., adults and larvae; Mochlostyrax jamaicensis Gbhm., adults and larvae; Howardina aureostriata Gbhm., adults and larvae; Corethrella appendiculata Gbhm., adults and larvae, July 2

**Balfour, Andrew.** Khartoum, Africa. Mansonia uniformis Theo., adult, Nov. 14

**Joutel, L. H.** New York city. Wyeomyia smithii Coq., pitcher plant mosquito, larvae on pitcher plant, May 7. Lakehurst, N. J.

**Haines, L.** Rhinebeck, N. Y. Contarinia violicola Coq., violet gall midge, larvae on violet, Oct. 10

*Lepidoptera*

**Dibb, F. S.** Ushers, N. Y. Satyrodes canthus Linn., adult, July 21

**Guernsey, W. J.** Albany, N. Y. Sphecodina abbotii Swainson, larvae on woodbine, July 13

**More, Alex.** Rockville Center, L. I., N. Y. Citheronia regalis Fabr., hickory horned devil, caterpillar, Sept. 13

**Russell, S. J.** Blue Point, N. Y. Apatela americana Harris, larva on maple, Aug. 20

**VanDenburg, M W.** Mt Vernon, N. Y. A. interrupta Guen., larvae, Aug. 28

**Graves, George S.** Newport, N. Y. Arsilonche albovenosa Goeze, adult, June 10

**Gabriel, M.** Mileses, N. Y. Hadena arctica Boisd., cutworm, adult, July 28

**Erwin, J. M.** New Salem, N. Y. Peridroma margaritosa Haw., variegated cutworm, larvae; light army worm, Heliophila unipuncta Haw., July 25

**Lutz, F. E.** Cold Spring Harbor, N. Y. Paragrotis messoria Harris, dark-sided cutworm, larvae, May 30; Papaipema nitela Guen., larvae, June 26

**Martin, S. C.** Schenectady, N. Y. Paragrotis messoria Harris, dark-sided cutworm, larvae, June 1

**Fitch, F. A.** Randolph, N. Y. Mamestra adjuncta Boisd., adult, May 21

**Stevens, C. N.** South Gilboa, N. Y. Catocala relicta Walk., moth, Sept. 20

**Bartlett, Alice E.** Delhi, N. Y. C. grotiana Bailey, Aug. 13

**Holt, Emmett.** New York city. Paleacrita vernata Pack., spring canker worm, larva on apple, June 4

**Theobald, F. V.** Egypt. Earias insulana Boisd., eggs, larvae, adult on cotton, Dec. 23

**Von Schrenk, Hermann.** ?Oiketicus abbotii Grote, southern bagworm on cyprus, Jan. 8. New Orleans, La.

**Mekeel Bros.** Yorktown Heights, N. Y. Sibine stimulea Clem., saddleback caterpillar, larva, Aug. 16

**Beebe, F. N.** Walton, N. Y. Enclea delphinii Boisd., slug caterpillar, larvae, Sept. 4

**Weston, Helen.** West New Brighton, S. I., N. Y. Zeuzera pyrina leopard moth, larvae in maple, Sept. 7

**Wilson, F. P.** Schenectady, N. Y. Sesia pictipes Gr. & Rob., larvae on plum, June 15

**Joutel, L. H.** New York city. ?Thiodia, species on oak, May 24

**Stevens, Robert L.** Westbury, N. Y. Eulia politana Haw., pine tube builder on white pine needles, Jan. 10

**Covert, H. W.** Waterford, N. Y. Coptodisca splendoriferella Clem., resplendent shield bearer, work, Sept. 30

*Neuroptera*

**Blakeslee, G. G.** Rensselaer, N. Y. Corydalis cornuta Linn., devil fly or horned Corydalis, adult, July 14

**Connally, E. F.** Troy, N. Y. Chauliodes pectinicornis Linn., comb horned fish fly, adult, July 28

*Hemiptera*

**Lutz, F. E.** Cold Spring Harbor, N. Y. Tibicen septendecim Linn., periodical cicada, adult, May 28; Phylloxera caryaeglobuli Walsh, June 4

**Smith, H. D.** Center Moriches, N. Y. Tibicen septendecim Linn., periodical cicada, adult, June 12

**Barry, Thomas.** Albany, N. Y. Belostoma americana Leidy, Apr. 19

**Linsley, Julius G.** Oswego, N. Y. Schizoneura americana Riley, young and adults on elm, June 22

**Andrews, James M.** Schenectady, N. Y. Chermaphis abietis Linn., spruce gall aphid, galls, June 20

**Cockerell, T. D. A.** Boulder, Col. Alcyrodes betheli Ckll. M. S., on Berberis, Sept. 27. Ourav, Col.; Chrysomphalus rossi Mask., Sept. 27. Lucban, P. I.; Coccus diversipes Ckll., on fern, Sept. 27. Lucena, P. I.

**Pettis, C. R.** Saranac Junction, N. Y. Chermes pinicorticis Fitch, pine bark aphid, hatching young on pine, May 29

**Anderson, J. R.** Victoria, B. C. Parlatoria proteus Curt., on Japanese orange, Jan. 4; Pseudaonidia duplex Ckll., on orange from Japan, Dec. 18; Aspidiotus rapax Comst., greedy scale on California lemon, Jan. 4; Hemichionaspis minor? Mask., on orange from Japan, Dec. 18

**Moore, Reuben.** Chatham, N. Y. A. ancylus Putn., adult on apple, Jan. 15

**Bostwick, Fred.** Poughkeepsie, N. Y. Aulacaspis rosae Bouché, rose scale on rose, Apr. 3

**Wheeler, M. S.** Berlin, Mass. Aulacaspis rosae Bouché, rose scale on blackberry, Aug. 13

**Dunbar, John.** Rochester, N. Y. Diaspis carueli Targ., juniper scale, adult on Pinus aristata and Juniperinus virginiana, Apr. 16

**Stevens, Robert L.** Westbury, L. I., N. Y. Chionaspis pinifoliae Fitch, scurfy pine scale on Scotch pine needles, Jan. 10

**Fellows,** *Miss* **F. E.** Norwich, Ct. Eulecanium tulipiferae Cook, tulip tree scale, young and adults on tulip, Sept. 17

**Mead, Herbert.** Lake Waccabuc, N. Y. Eulecanium tulipiferae Cook, tulip tree scale, young and adults on tulip, July 27

**Niles, T. F.** Chatham, N. Y. E. nigrofasciatum Perg., terrapin scale on maple, Sept. 13

**Van Fredenberg, H. A.** Port Jervis, N. Y. Pseudophilippia quaintancii Ckll., woolly pine scale, adults on pitch pine, Nov. 20; Phenacoccus acericola King, false maple scale, adults and young on maple, July 24

**Pierce, Charles M.** Adams, N. Y. Pulvinaria innumerabilis Rathv., cottony maple scale, adults and young on Virginia creeper, July 3

**Studwell, Edward F.** Port Chester, N. Y. Phenacoccus acericola King, false maple scale, larvae on maple, Sept. 18

*Orthoptera*

**Morehouse, F. A.** Ripley, N. Y. Oecanthus niveus DeG., whit flower cricket, eggs on grape, Apr. 30

**Williams, William.** Milton, N. Y. Gryllotalpa borealis Burm mole cricket, adult, Oct. 8

**Richard, George L.** Diapheromera femorata Say, walkin stick, adult, Oct. 12, Altamont, N. Y.

**Palmatier, Tilden.** Athens, N. Y. Periplaneta australasia Fabr., Australian cockroach, nymph, June 7

*Miscellaneous*

**Alexander, Charles.** Gloversville, N. Y. Some of the more desirable forms donated by him follow: Bembidium ustulatum Linn. Agabus seriatus Say, Choleva terminans Lec., Philonthus umbrinus Grav., Lathrobium punctulatum Lec., Tachinus memnonius Grav., T. luridus Er., Dermestes frischii Kug., Anthaxia aeneogaster Lap., Stephanocleonus plumbeus Lec., Atymna castanea Fitch, Carabus serratus Say, Necrophorus americanus Oliv., Alaus myops Fabr., Calloides nobilis Say, Tylonotus bimaculatus Hald., Neuronia pardalis Walk.

**Exchange**

**E. S. Tucker.** Lawrence, Kan. Ophion idoneum Vier., Bracon xanthostigma Cr., Melanobracon ulmicola Vier., Agathis vulgaris Cr., Calyptus rotundiceps Cr., Aphaereta dolosa Vier., Nemigonia limosa Wheel., Lasius niger Linn. var. americanus Emery, Pelecinus polyturator Dru., Pompilus relatinus Fox, Isodontia azteca Sauss., Tachytes spatulatus Fox, Tachytes obscurus Cr., Spechius speciosus Dru., Euspongus bipunctatus Say, Mellinus rufinodus Cr., Mimesa punctata Fox, Stigmus inordinatus Fox, Epeolus occidentalis Cr., Clisodon terminalis Cr.

Staphylinus maculosus Grav., Romaleum atomarium Dru., Myochrous denticollis Say, Tomicus grandicollis Eich.

Catocala junetina Walk var. aspasia Strk.

Ceratopogon squamipes Coq., Scatopse notata Loew., Allognosta fuscitarsis Say, Tabanus sulcifrons Macq., Xylomyia pallipes Loew., Deromyia ternata Loew., Erax stamineus Will., Psilopodinus sipho Say, Dolichopus bifractus Loew., Dolichopus cuprinus Wied., D. longipennis Loew., Empis clausa Coq., Rhamphomyia nasoni Coq., Eupeodes volucris O. S., Allograpta obliqua Say, Oncomyia loraria

Loew., Myiophasia aenea Wied., Siphoplagia anomala Town., Blepharipeza leucophrys Wied., Paradidyma singularis Town., Myiocera cremides Walk., Sarcophaga helicis Town., Morellia micans Macq., Limnophora narona Walk., Phorbia cinerella Fall., Coenosia lata Walk., Schoenomyza dorsalis Loew., Scatophaga furcata Say, Borborus equinus Fall, Lonchaea polita Say, Pachycerina dolorosa Will., Pseudotephritis cribrum Loew., Straussia longipennis Wied., Urellia actinobola Loew., Calobata antennipes Say, Nemopoda minuta Wied., Elachiptera costata Loew., Oscinis coxendix Fitch, Drosophila graminum Fall., Phormia regina Meig.

Corimelaena nitiduloides Wolff., Melanaethus uhleri Sign., Oebalus pugnax Fabr., Menecles insertus Say, Catorhintha mendica Stal., Anasa armigera Say, Hadrodema pulverulenta Uhl., Tygus distantii St. F., Nabis rufusculus Reut., Sinea raptoria Stal., Agallia 4-punctata Prov., Deltocephalus melsheimeri Fabr., Dicraneura abnormis Walsh., Oncometopia costalis Fabr., Orthotylus flavosparsus Dhlb.

Hemerobius stigmaterus Fitch, Chrysopa nigricornis Burm., C. florabunda Fitch, Hydropsyche kansensis Bks., H. phalerata Hag., H. scalaris Hag.

Stylopyga orientalis Linn.

Sympetrum corruptum Hag.

*Chrysididae*

**Mocsary, A.** Budapest, Hungary. Cleptes pallipes Lep., Notozus panzeri Fabr., Elampus auratus Linn., E. auratus var. virescens Mocs., E. bogdanovii Rad., E. aeneus Fabr., Holopyga amoenula Dhlb., H. amoenula var. punctatissima Dhlb., H. ahenea Dhlb., H. curvata Forst., H. gloriosa Fabr., H. chrysonota Forst., H. rosea Rossi, Hedychrum gerstaeckeri Cheve., H. nobile Scop., H. rutilans Dhlb., Stilbum cyanurum Forst. var. amethystinum F., Chryrogona pumila Rl., Spintharis vagans Rad., Chrysis austriaca Fabr., C. cuprea Rossi, C. dichroa Dhlb., C. elegans Lep., C. versicolor Spin., C. saussurei Cheve., C. succincta Linn., C. leachii Shuck., C. cyanea Linn., C. nitidula Fabr., C. viridula Linn., C. ignita Linn., C. splendidula Rossi, C. rutilans Oliv., C. scutellaris F., C. scutellaris var. ariedne Mocs., C. inequalis Dhlb., C. comparata Lep., C. chloris Mocs., C. lyncea F. var. papuana Mocs., C. sexdentata Christ., C. (Euchroeus) purpuratus F., Tarnopes grandior Tall. (carnea Rossi)

*Diptera*

**Kertesz,** *Dr* **C.** Budapest, Hungary. Tabanus tergestinus Egg., T. sudeticus Zell., T. spodopterus Meig., T. rusticus Fabr., T. quatuornotatus Meig., T. graecus F.?, T. fulvus Meig., T. tropicus Linn., T. bromius Linn., T. bovinus Linn., T. autumnalus Linn., T. auripilus Meig. var. aterrimus. T. africus Meig., Culex dorsalis Meig., C. vexans Meig., C. cantans Meig., C. ornatus Meig., C. pulcritarsis Rond., C. modestus Ficl., C. pipiens L., C. annulipes Meig., Aedes cinereus Meig., Anopheles maculipennis Meig.

*Culicidae*

**Crum, Ebb.** Lawrence, Kan. Anopheles maculipennis Meig., Psorophora ciliata? Abr. young larva, Ecculex sylvestris Theo., Culex restuans Theo., C. territans Walk., C. ?tarsalis Coq., C. salinarius? Coq., Grabhamia discolor Coq., G. jamaicensis Theo., Culicada canadensis Theo.

*Tachinidae*

**Bezzi, Mario.** Torino, Italy. Meigenia bisignata Meig., Dexodes machaeropsis R. D., Hemimasicera ferruginea Meig., Parexorista polychaeta, Blepharida vulgaris Fall. var. stridens Bd., Perichaeta unicolor Fall., Mintho praeceps Scop., Melanota volvulus Fabr., Anthracomyia melanoptera Fall., Macquartia chalconota Meig., M. dispar Fall., Thelaira leucozona Panz., Zophomyia temula Scop., Myobia inanis Fall., Ocyptera bicolor Oliv., O. brassicaria Fabr., Bonellia picta Meig., Ernestia consobrina Meig., Echinomyia grossa Linn., Eudoromyia magnicornis Zett., Plagia ruralis Fall., Phasia crassipennis Fabr., Brachycoma devia Fall., Rhinophora atramentaria Meig., Metopia leucocephala Ross., Miltogramma oestracea Fall., Dexiosoma caninum Fabr.

**Purchase**

**Snow,** *Prof.* **F. H.** Lawrence, Kan. Psychoda alternata Say, Ceratopogon argentatus Lw., C. pergandei Coq., C. specularis Coq., Anopheles pseudopunctipennis Theo., Neoglaphyroptera bivittata Say, Cecidomyia radiatae Snow, Chrysops aestuans V. d. W., C. celer O. S., C. flavidus Wied., C. fugax O. S., C. indus O. S., C. striatus O. S., C. univittatus Macq., Tabanus costalis Wied., T. lasiophthalmus Macq., T. melanocerus Wied., T. molestus Say, T. nivosus O. S., T. pumilus Macq., T. stygius Say, T. trimaculatus P. B., T. venustus O. S., Eumetopia rufipes Macq., Stenopa vulnerata Lw., Plagiotoma obliqua Say, Carphotricha culta Wied., Neaspilota alba Lw., Tephritis clathrata Lw., Urellia solaris Lw.

Anelastes drurii Kir., Ischiodontus soleatus Say, Glyphonyx recticollis Say, Corymbites hieroglyphicus Say, Pyrophorus physoderus Germ., Euthysanius lautus Lec., Plastocerus schaumii Lec., Hylotrupes bajulus Linn., Sphaenothecus suturalis Lec., Coenopoenus palmeri Lec., Leptostylus aculiferus Say, Mecas inornata Say, Macrorhoptus estriatus Lec., Conotrachelus similis Boh., C. leucophaeatus Fah., Pityophthorus nitidulus Mann., Dendroctonus similis Lec., Hylastes nigrinus Mann., Lasioderma testaceum Duft., Hemiptychus gravis Lec., Sinoxylon simplex Horn., S. sericans Lec., S. sextuberculatum Lec., Amphicerus fortis Lec., A. punctipennis Lec., Polycaon obliquus Lec., Lyctus californicus Cr.

Total ..... 357

## ZOOLOGY

### Donation

#### *Mammals*

**Calhoun, Fred.** Albany. Big brown bat, Vespertilio fuscus Beauvois ..... 1

**Dawley, F. E.** Fayetteville. Woodchuck (melanistic), Arctomys monax (Linn.) ..... 1

**Richard, W. C.** West Waterford. Rock pika, Ochotona saxatilis Bangs, Wyoming ..... 1

**Vander Veer, William.** Cobleskill. Wildcat, Lynx ruffus (Gueldenstaedt) ..... 1

#### *Birds*

Those marked † are sex or plumage specimens new to the collection.

**Alexander, C. P.** Gloversville. Nashville warbler, Helminthophila rubricapilla (Wilson), eggs ..... 2

Migrant shrike, Lanius ludovicianus migrans Palmer, eggs ..... 2

**Hall, C. K.** Albany. Hairy woodpecker, Dryobates villosus (Linn.) ..... 1

**Higgins, Charles D.** Spencertown. Many-storied nest of robin, Merula migratoria (Linn.) ..... 1

**Short, E. H.** Coldwater. †Pied-billed grebe, Podilymbus podiceps (Linn.) ..... 2

#### *Reptiles and batrachians*

**Alexander, Charles P.** Gloversville. Milk snake, Osceola doliata triangula (Boie) ..... 1

Spotted salamander, Amblystoma punctatum (Linn.) .... 1

**Card, Leroy Cox.** Albany. Chameleon, Anolis principalis (Linn.) (Captured in American Express office, Albany) ..... 1

**Olcott, Douglas W.** East Greenbush. Ring-necked snake, Diadophis punctatus (Linn.) ..... 1
**Spencer, J. I.** Albany. Young garter snakes, Eutaenia sirtalis (Linn.) (Taken from two females) ..... 145
**State Barge Canal office,** Albany. Blowing adder, Heterodon platyrhinus Latreille ..... 1

### *Invertebrates*

**Alexander, Charles P.** Gloversville. Spiders and phalangids..... 71
Myriapods ..... 3
Wood louse, Porcellio rathkei Brandt..... 1
**Edmonds, W. D.** Alder Creek. Polyzoan, Pectinatella magnifica Leidy ..... 1
**Hibbard,** *Dr* **D. V. M.** Olean. Cave shrimp, Crangonyx tenuis Smith (From a driven well)..... 9
**Irwin,** *Miss.* Clinton Heights. Spider, Epeira trifolium Hentz ..... 1
**Lutz, F. E.** Cold Spring Harbor. Myriapod, Iulus..... 1
**Miller, W.** Nassau, Bahama Is. Spiders, Latrodectus mactans (Fabricius)..... 9
**Ortmann, A. E.** Princeton, N. J. Crayfish from Pennsylvania.
Cambarus diogenes Girard..... 2
Cambarus limosus (Rafinesque)..... 2
Cambarus monongalensis Ortmann..... 3
Cambarus obscurus Hagen..... 2
Cambarus bartoni robustus Faxon..... 1
**Polk, George W.** Poughkeepsie. Spider..... 1
**Weed, C. M.** Sinclairville. Hairworm, Paragordius varius Leidy ..... 1
——— Albany. Huntsman spider, Heteropoda venatoria (Linn.) (Probably brought north in bananas)..... 1

## Purchase

### *Mammals*

**Williams, George.** Rexford Flats. Wildcat, Lynx ruffus (Gueldenstaedt) ..... 1

### *Birds*

Birds marked * are species new to the collection.
Those marked † are sex or plumage specimens new to the collection.

**Dooley, T. J.** Albany. American osprey, Pandion haliaetus carolinensis (Gmel.)..... 2
**Guelf, George F.** Brockport. Caspian tern, Sterna caspia Pallas 1
Wilson's petrel, Oceanites oceanicus (Kuhl)..... 1
†Red-breasted merganser, Merganser serrator (Linn.).. 1
White-winged scoter, Oidemia deglandi Bonaparte.... 1
†Surf scoter, Oidemia perspicillata (Linn.)..... 1

†Little blue heron, Ardea caerulea Linn. . . . . 1
†Black-bellied plover, Squatarola squatarola (Linn.). . 1
*Belted piping plover, Aegialitis meloda circumcincta Ridgway . . . . . 1
†Broad-winged hawk, Buteo latissimus (Wilson) . . . . . 1
†American rough-legged hawk, Archibuteo lagopus sanctijohannis (Gmel.) . . . . . 1
Green-crested flycatcher, Empidonax virescens (Vieillot) . . . . . 1
*Alder flycatcher, Empidonax trailli alnorum Brewster . . . . . 1
†Cerulean warbler, Dendroica rara Wilson . . . . . 1
Mourning warbler, Geothlypis philadelphia (Wilson) 1
†Varied thrush, Hesperocichla naevia (Gmel.) . . . . . 1

**Parker, Foster.** Cayuga. *American white pelican, Pelecanus erythrorhynchos Gmel. . . . . 1
Baldpates, Mareca americana (Gmel.) . . . . . 2
†Least bittern, Ardetta exilis (Gmel.) . . . . . 1
*Hybrids between game bantam and English pheasant . . . . . 2

**Ward's Natural Science Establishment.** Rochester. *Black-throated loon, Gavia arctica (Linn.) . . . . . 1
†Dovekie, Alle alle (Linn.) . . . . . 1
*Pomarine jaeger, Stercorarius pomarinus (Temm.). . 1
*Herring gull, Larus argentatus Brünn . . . . . 1
*Fulmar, Fulmarus glacialis (Linn.) . . . . . 1
*Cory's shearwater, Puffinus borealis Cory . . . . . 1
American white pelican, Pelecanus erythrohynchos Gmel. . . . . 1
†Lesser scaup duck, Aythya affinis (Eyt.) . . . . . 1
†Harlequin duck, Histrionicus histrionicus (Linn.). . 1
†American eider, Somateria dresseri Sharpe . . . . . 1
Least bittern, Ardetta exilis (Gmel.) . . . . . 1
†Sandhill crane, Grus mexicana (Müller) . . . . . 1
*Long-billed dowitcher, Macrorhamphus scolopaceus (Say) . . . . . 1
*Ruff, Pavoncella pugnax (Linn.) . . . . . 1
*Hudsonian curlew, Numenius hudsonicus Lath. . . . . 1
†Black-bellied plover, Squatarola squatarola (Linn.). . 1
†Broad-winged hawk, Buteo latissimus (Wilson) . . . . . 2
*Red-naped sapsucker, Sphyrapicus varius nuchalis Baird . . . . . 2
†Red-bellied woodpecker, Melanerpes carolinus (Linn.) 1
*Scissor-tailed flycatcher, Milvulus forficatus (Gmel.). 1
Bullock's oriole, Icterus bullocki (Swainson) . . . . . 1
†Grasshopper sparrow, Ammodramus savannarum passerinus (Wilson) . . . . . 1
*Leconte's sparrow, Ammodramus lecontei (Audubon) 1
*Nelson's sparrow, Ammodramus caudacutus nelsoni (Allen) . . . . . 1

*Acadian sharp-tailed sparrow, Ammodramus caudacutus subvirgatus (Dwight)..... 1
†Cardinal, Cardinalis cardinalis (Linn.)..... 1
Painted bunting, Cyanospiza ciris (Linn.)..... 1
*Plumbeous vireo, Vireo solitarius plumbeus (Coues) 1
†Prairie warbler, Dendroica discolor (Vieillot)..... 1
*Grinnell's waterthrush, Seiurus noveboracensis notabilis (Ridgway)..... 1
*Connecticut warbler, Goethlypis argilis (Wilson)..... 1
†Mourning warbler, Geothlypis philadelphia (Wilson) 1
*Carolina chickadee, Parus carolinensis Audubon..... 1
†Bluegray gnatcatcher, Polioptila caerulea (Linn.).... 1

*Invertebrates*

**Ward's Natural Science Establishment.** Rochester. Peripatus, Peripatus novaezealandiae..... 1

## Collection

*Mammals*

Deer, Odocoileus americanus (Erxleben)..... 1
Woodchuck, Arctomys monax (Linn.)..... 1
Deer mouse, Peromyscus leucopus noveboracensis (Fischer)..... 1
Naked-tailed mole, Scalopus aquaticus (Linn.)..... 1

*Birds*

Sora, Porzana carolina (Linn.) (With material for group) 2
†American coot, Fulica americana Gmelin..... 1
Ruffed grouse, Bonasa umbellus (Linn.)..... 3
†American sparrow hawk, Falco sparverius Linn..... 2
Yellow-billed cuckoo, Coccyzus americanus (Linn.) eggs..... 3
Crested flycatcher, Myiarchus crinitus (Linn.)..... 1
†Canada jay, Perisoreus canadensis (Linn.)..... 1
Purple finch, Carpodacus purpureus (Gmel.)..... 1
Savanna sparrow, Ammodramus sandwichensis savanna (Wilson)..... 1
†Henslow's sparrow (?), Ammodramus henslowi (Audubon)..... 1
Slate-colored junco, Junco hyemalis (Linn.) (With material for group)..... 2
†Towhee, Pipilo erythrophthalmus (Linn.)..... 1
Indigo bunting, Cyanospiza cyanea (Linn.)..... 1
Red-eyed vireo, Vireo olivaceus (Linn.)..... 1
Yellow-throated vireo, Vireo flavifrons Vieillot..... 1
Blue-headed vireo, Vireo solitarius (Wilson)..... 1

Nashville warbler, Helminthophila rubricapilla (Wilson)..... 1
Yellow warbler, Dendroica aestiva (Gmel.)..... 1
Cerulean warbler, Dendroica rara Wilson..... 1
Chestnut-sided warbler, Dendroica pennsylvanica (Linn.)..... 1
†Blackpoll warbler, Dendroica striata (Forst.)..... 1
Yellow-breasted chat, Icteria virens (Linn.) (With material for group)..... 2
House wren, Troglodytes aëdon Vieillot..... 1
†Winter wren, Anorthura hiemalis (Vieillot)..... 1
Long-billed marsh-wren, Cistothorus palustris (Wilson) eggs ..... 2
Red-breasted nuthatch, Sitta canadensis Linn..... 1

### *Reptiles*

Milk snake, Osceola doliata triangula (Boie) by members of the entomological staff..... 1

### *Invertebrates*

About 250 specimens of invertebrates, almost wholly spiders (Araneida) have been collected, one third of these by members of the entomological staff..... 250

**Total**..... 621

## ARCHEOLOGY

### Donation

**Conner, Arthur.** Walton, N. Y. 1 single winged bannerstone from Shinhopple, Hancock township, Delaware co. Found on bank of Delaware river

**Persons, G. H.** Catskill. Two humeri with perforations of the olecanon cavity from skeleton of an Indian female found on the Du Bois farm, Catskill

**Richard, George L.** Waterford. Chipped implements of red Westchester slate from Peobles island

**Burmaster, Everett.** 1 small celt found on Newton farm, Irving

**Mattern, J. E.** West Rush. 86 fragments of pipe stems from Seneca village of Totiacton (Rochester junction)

**Beardsley, Egbert.** Catskill. 2 hammer stones and one net sinker from Catskill

### Purchase

DURING MARCH AND APRIL 1906

1 false face, Ga-goh-sah
1 false face, Ga-goh-sah, Seneca tribe. Used in marching ceremonial
1 ceremonial mask, Ga-goh-sah, Seneca tribe, Tonawanda bank. Pur-

chased March 17, 1906. This mask is supposed to be imbued wit the spirits of birds. It was an important mask of the Tonawand Lodge of the False Face Company

1 husk face. Doorkeeper's mask of the Husk Face Company. Objec illustrating the uses of the *corn* plant to the Iroquois.

1 lover's flute, Ye-o-da-wus-toh. Purchased April 13, 1906, on th Tonawanda Reservation. Seneca tribe. Flute made 1804 by Chie Senoiucieh (A. Charl)

1 flute, Seneca tribe, Tonawanda band. Purchased March 17, 190 Flutes of this kind were used by lovers to serenade their sweet hearts.

1 silver hatband, Di-ye-sta-hus-tah or Di-ye-ga-hi-hus-toh; Seneca Worn by Chief *Dwa-ni-o-no,* Tall Peter. The last treasured crow of the Tonawanda sachems. Purchased April 15, 1906

10 Seneca silver brooches, purchased on the Tonawanda Reservation April 13, 1906. Brought from the Genesee reserve. A rare patter

4 miscellaneous brooches and a portion of a dress ornament

13 silver brooches as follows, known as Chief Sundown's brooches

7 council brooches

2 Medicine Lodge brooches (owl)

1 star and circle — sun brooch

1 marriage brooch

2 large Wolf council fire brooches

20 double bar council brooches, iniuska De-io-a-wan; records o Seneca councils. Purchased April 13, 1906 on Tonawanda Reservatio

4 single bar brooches, Ska-wen iniuska. Seneca tribe

3 silver brooches, iniuska. Purchased on Tonawanda Seneca Reser vation, March 17, 1906. The two large brooches are said to hav been made before the Revolutionary War from English coins

3 pairs of silver earrings, Tonawanda, March 17, 1906

1 covered provision basket, Ga-us-ha-wa-da-we-shas. Unusually fin weave. Purchased on the Tonawanda Reservation, April 13, 1906

1 bark basket

1 bread bowl (wooden) Ga-o-wa a-kwa. Seneca tribe, Tonawanda band. Purchased March 16, 1906. Used for mixing hulled corn meal for boiled bread. Made by Black Squirrel, 1814

1 child's spoon, Ah-to-gwus-ha. Seneca tribe

2 wooden spoons, Ah-to-gwus-ha. Tonawanda tribe. Purchased March 16, 1906

1 Weasel skin charm. This skin contains certain charm powders much prized by the Iroquois for their reputed luck-giving powers. To awaken the spirit of the charm one must strike himself with the skin, when it will be susceptible to commands. Without special invocation, it is considered a potent charm against diseases of the chest.

1 water drum, Ga-noh-jah. Seneca tribe, Tonawanda band. Purchased March 15, 1906. This was the lodge drum of the Buffalo Society.

2 Heron feather fans, used in the ceremonies of the Seneca Order of the Eagles, a native Indian fraternity of great antiquity. These fans belonged to Gaioyade, the chanter of the Eagles, and a member

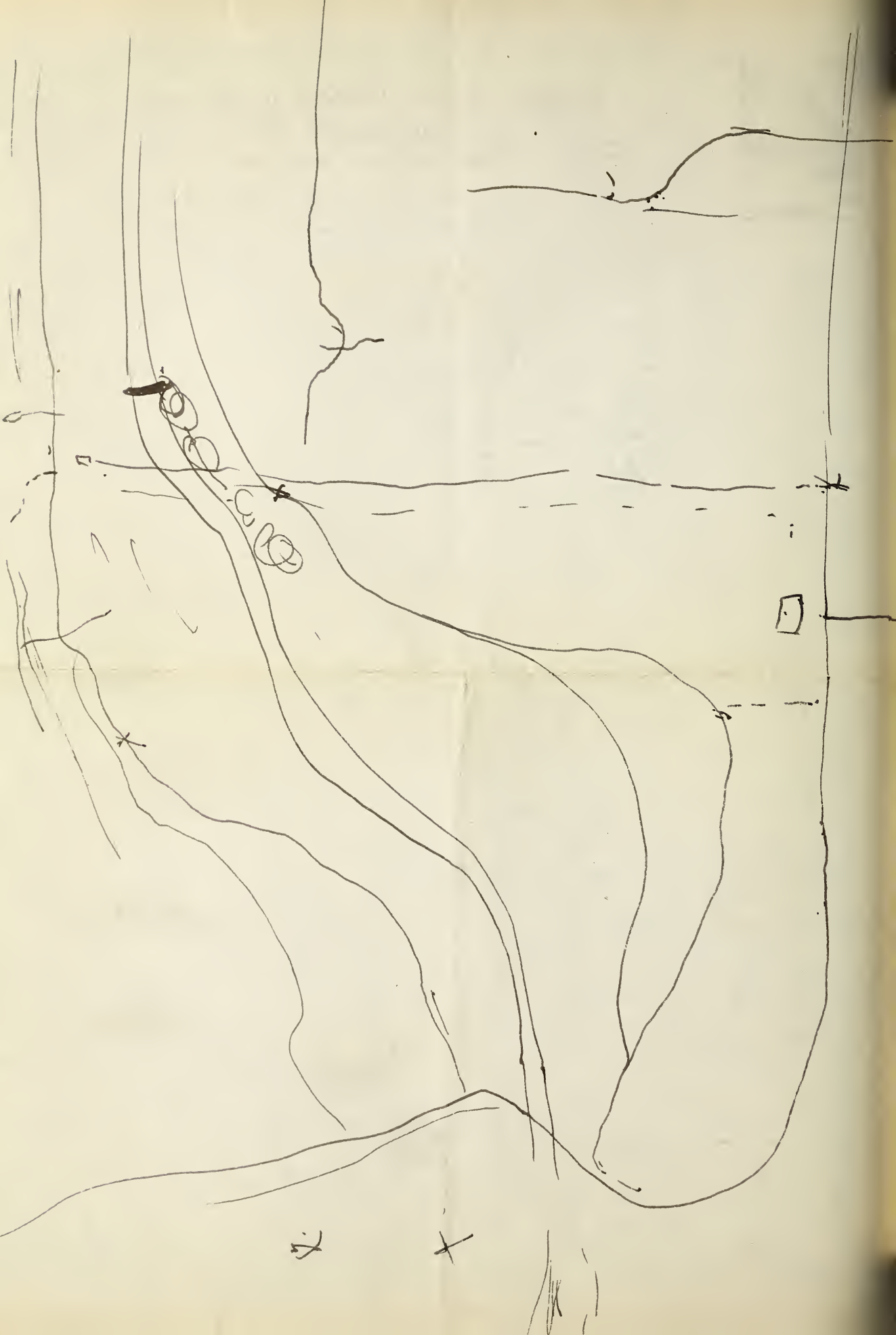
# *Dwight Foster Historical Museum*


102 MILWAUKEE AVENUE E.

FORT ATKINSON, WISCONSIN

*ZIDA C. IVEY, Director* *Phone 956*


400 Madison Ave



of the Heron clan. Heron feather fans must always have six feathers, but a fan of Eagle feathers may contain four. A picture accompanying these specimens illustrates the use of the fans and rattles in the lodge ceremonies of the Eagles. Purchased at Newtown Reservation, near Lawton Station, N. Y., March 30, 1906

2 gourd rattles used with Heron feather fans in the Seneca Eagle dance. The rattles are held in the right hand and the fans in the left. These rattles were the property of the singer of the Order of the Eagles, a Seneca secret fraternity of great antiquity.

1 great feather dance rattle (turtle shell). For many years this was the Long House rattle of the Senecas and was always used in the celebration of their sacred dance. It is unlike the false face rattles in that the sternum is or was stained red in token of its sacred employment. Purchased March 27, 1906

1 rattle of the Eagle Society. Gaa-né-gwe-e Gus-nohgus-to-we-se. Purchased on the Cattaraugus Reservation, March 19, 1906. This rattle must not be confused with the bark rattles of the False Face Company.

4 horn rattles, Gus-to-wūs-ha O-nonk-ga. Seneca tribe, Tonawanda band. Purchased March 16, 1906. These rattles have been used for many years by the Eagle Medicine Society of the Senecas in their secret ceremonies.

1 tobacco pole, such as is now used instead of a dog pole in the midwinter ceremonies of the Senecas. Purchased April 1906

8 moon dance buttons, Gus-keh-i-seh-doh. Deer bone button game. Purchased on Tonawanda Seneca Reservation, March 16, 1906. These buttons were used in the moon dance ceremony for many years and are very old. In the game, they are thrown from the hand, the counts being as follows: all of one color, 20; one of a color, 4; two of a color, 2. Opposite clans contest in the moon dance. Beans are used for counters and the party winning all the beans will enjoy the favor of the moon for the ensuing year.

8 buttons, Gus-keh-i-seh-doh. Deer bone button game. Purchased on Tonawanda Reservation, March 17, 1906. These game "buttons" were used by the Tonawanda Senecas in the moon dance ceremony. The moon is said to love the game because the buttons are patterned after her face.

6 peach stone dice, used at Tonawanda Long House for 40 years play the sacred bowl game at the annual midwinter festival. Purchased March 16, 1906

1 baby board, Ga-o-yas-ha. Seneca tribe, Tonawanda band. Purchased March 15, 1906. Ga-ni-o-dai-euh, a tribal successor to Handsome Lake, a Seneca prophet, was strapped to this board when an infant.

1 baby board, Ga-o-yas-ha. Seneca tribe, Tonawanda band. Purchased on Tonawanda Reservation, March 16, 1906. This board was used by Stephen Skeye, Gah-don-dyieh, Flying Feathers. Baby boards are good examples of Indian carved woodwork.

1 burden strap, Gus-ha-a. Purchased April 13, 1906 on Tonawanda Reservation. This strap is made of elm bark and was found in use.

1 burden strap, Gus-ha-ah. Seneca tribe, Tonawanda band. Purchased March 16, 1906. Woven from native material and said to have been in use before the War of 1812. Found in use
1 Seneca woman's skirt, Ga-ka-a. Purchased April 13, 1906 on Tonawanda Reservation. Found in use
1 beaded binding blanket of broadcloth for baby board, Gus-swa-hus-ha. Purchased on Tonawanda Reservation March 17, 1906. This blanket was said to be the last of the kind to be found among the New York Senecas. (2 pieces, 1 red and 1 blue)
1 pair of moccasins made in 1878 by a Seneca woman after the old Mohawk style. The moose hair embroidered pattern on the toes is now widely copied on moccasins sold for commercial purposes. Purchased March 27, 1906
1 pair of baby moccasins, Ga-zun-i-ah Ata-kwa. Seneca tribe, Tonawanda band. Purchased on Tonawanda Reservation, March 16, 1906. The hole in the sole of one moccasin is purposely made that the baby may tell the spirits that seek to lure it to the spirit world that it is not properly shod for the long journey of death, since strong, new moccasins must be on the feet of those who journey skyward.
1 pair of ceremonial leggings, Gais-hăl. Formerly owned by the daughter of Black Squirrel. Purchased on the Tonawanda Reservation, March 16, 1906
1 pair of women's leggings, Gais-hăh. Seneca tribe. Tonawanda Reservation. Purchased March 16, 1906
2 short snow snakes, Ni-wa-ah ga-was-sa. This short form of the snow snake is said to have been devised by the Tonawanda band of Senecas, who discovered that they could throw them with greater ease and at a greater distance than the long "sticks" in general use. Purchased March 16, 1906, on Tonawanda Reservation

PURCHASED JUNE 1906

1 Gus-to-weh or Seneca ceremonial hat, used by Chief Kettle for 16 years in the Great Feather ceremony
1 bark cooking bowl purchased from Chief Ga-niu-dai-euh
1 husk basket used in the Seneca Dark Dance ceremony
1 husk salt bottle, made by Ho-non-di-ont O-dan-koat

**Mattern, Joseph E.** West Rush, Monroe co. N. Y.

Celts from Monroe county

6 celts, beveled on one side and flat on other side, West Rush
1 celt, large, beveled on one side and flat on other side, West Rush
1 celt, round top, flat bottom
7 equilateral celts
1 round celt
1 double edged celt, small
1 long celt from Honeoye creek
1 equilateral celt
2 rude celts
1 flat bellied celt
4 gouges

Celts from Livingston county
3 short, broad celts from Caledonia
2 flat bellied celts
3 small flat bellied celts
1 celt, very small
1 polished flint celt, small
1 broad celt from Fort Hill
3 gouges
1 broken celt from Chittenango county
1 large celt from Ontario county
1 black celt, rounded type
3 matetes from Fort Richmond
3 pitted hammer stones
5 type 1 hammer stones
5 type 2 hammer stones
3 pitted, type 3 hammer stones
2 type 3-1 hammer stones
1 pestle, Livingston county
1 pestle
4 pestles from West Rush, Monroe co.
1 pestle from Chenango county
1 perforated pendant
4 net sinkers
1 box containing specimens from the Woodruff farm, West Rush: 1 calcedony flake, 1 antler punch, 1 string of 20 tubular bone beads, 1 bone needle, fine perfect specimen, 4 imperfect bone needles, 14 bone awls
1 bone ball
5 brass points on card
3 brass cones on card
15 bone awls from Richmond Mills
9 fine large awls from Old Fort, Richmond Mills
1 fine awl from Woodruff farm, West Rush
1 bone harpoon point from West Rush
1 string of varicolored glass beads, (216)
1 string holding glass, shell and wampum beads
200 glass and wampum beads from Lima
1 string of round Venetian beads from Totiacton
1 string 4 feet long holding blue, white and red beads
1 string 2 feet long holding wampum beads from Dibble farm, Lima
2 perforated bear teeth
5 perforated wolf teeth
2 perforated elk teeth
2 phalanx cups
2 water snail shells
1 iron saw from Totiacton
1 iron spatula from Totiacton
2 bone reamers
1 section of bone reamer
1 fine specimen of antler awl

1 bone knife
1 antler point
1 bone awl
3 small antler chisels
1 string of tubular bone beads as follows: 18 tube beads of various sizes, 3 perforated phalanges, 5 femur perforated balls
1 bone tube from Woodruff farm
1 bone tube from Old Fort, Log Pond
12 conical legging rattlers
2 perforated lead balls
2 conical iron legging rattlers
2 spirally wound coils
3 catlanite beads
1 small Jesuit ring with picture representing the adoration of the Christ child by the wise men
10 large discoidal beads
48 small discoidal shell beads
23 tubular *busycon* cone beads
1 pendant
1 double diametrically drilled dot-decorated pendant
1 triangular pendant
2 fine specimens of bar amulets from West Rush
1 semilunar knife, exceptionally fine specimen from West Rush
1 gorget with single perforation from Hopewell, Ontario co.
1 gorget with two perforations from Gibbard farm, West Rush
1 gorget with a single perforation from West Rush
1 gorget double drilled and inscribed from York, Livingston co.
1 double perforated gorget from New York State farm, Rush
1 fragment of a gorget, Rush
1 half section banner stone, Rush
2 half sections banner stone, West Rush
1 portion broken shale knife
1 perforated tablet, West Rush
183 shouldered flints from Livingston county
8 blank blades from Livingston county
120 shouldered points from Monroe county
60 shouldered points from West Rush
2 triangular points from Rush
43 triangular points from West Rush, N. Y.
27 flints, various, West Rush, N. Y.
56 unusual points, Genesee valley
12 bunts, Genesee valley
17 long shouldered flints from Monroe county
13 broad shouldered flint points from Monroe county
6 spears from Afton
4 spears from Livingston county
3 knives, Livingston county
1 knife, Erie county, from site of Red Jacket's farm
1 iron knife blade
17 scrapers from Monroe county

60 flints from Livingston county
60 scrapers from Livingston county
12 bunts from Monroe county
9 spears from Monroe county
30 notched points from Monroe county
22 triangular flints from Monroe county
37 various flints from Piffard
10 blank blades from Piffard
9 points from West Rush
19 broad shouldered points from Rush
16 broad points from Rush
8 triangular points from Richmond Mills
4 bunts from Richmond Mills
73 shouldered points from Afton
15 variously formed points from Genesee Valley Junction
3 perforators
75 shouldered arrow points from Afton
17 triangular points from Genesee valley
17 scrapers from Livingston county
15 bunts from Monroe county
4 blanks from Monroe county
20 shouldered points from Monroe and Livingston counties
60 spears in box
22 large spears in box
325 points from Livingston and Monroe counties
31 scrapers
13 clay pipe bowls
7 fragments of pipe bowls
1 stone maskette
1 stone tube, highly polished, from Hemlock lake
1 depressed center-perforated discoidal stone
1 rare bone comb from Richmond Mills
7 perforated brass arrow points
10 triangular brass points from Totiacton
1 polished slate knife, rare specimen, from Avon
1 polished slate knife, chipped edges
1 winged and notched object of stone
2 bone draw scrapers
11 flints from Monroe county
20 flints from Monroe county
254 flint points from the Genesee valley
24 notched shouldered points from the Genesee valley

**Spear, William A.** Findley Lake, N. Y.
1 stone press, Indian make, from Ripley Crossing
1 stone hammer of polished black and white marble from Mina
1 black polished *chunkee* stone, from Gage's Gulf
1 grooved war club stone from Findley lake
1 chisel celt from Findley lake
1 celt chisel from Mina

3 celts from Ripley
1 moccasin last from French creek
1 adz from Chautauqua lake
2 gorgets from Clymer
1 celt from Mina
1 small pestle from Ripley
1 mottled stone pestle from Ripley
5 celts from French creek
1 celt from Mina
1 large quarry flake from Mina
1 large war club head from Findley lake
2 celts from Clymer
3 celts from Findley lake
1 obtuse edged celt from Erie (Pa.)
2 small celts from Ripley
1 large flake from Findley lake
1 bar celt from Mayville. A rare specimen
2 celts from Chautauqua
1 gorget from French creek
1 miniature pestle or plummet from French creek
6 celts from Chautauqua county
1 polished pipe with human face and deer's hoof from Findley lake
1 polished cup of oolitic limestone (Ind.) from Hauger farm, Findley lake
1 disk stone
50 flint points from Chautauqua county
1 varicolored jasper knife from Chautauqua
10 flint spearheads from Chautauqua
3 iron tomahawks from Lake Erie trail
1 wooden war club carved from curly maple. Picked up at Herkimer after the Indian raid of 1791. Exceptionally fine specimen

**Amidon,** *Dr* **R. W.** Chaumont, N. Y.

BONE ARTICLES FROM ST LAWRENCE COUNTY

4 bone awls made from bone splinters. Large specimens. St Lawrence county
4 bone harpoons from St Lawrence county
1 inscribed awl. Fine specimen from St Lawrence county
1 finely pointed cylindrical bone awl or broken harpoon. St Lawrence county
2 heavy bone splinter awls or spears. St Lawrence county
1 flat bone knife
1 tubular awl
3 splinter awls, broken
2 flat awls, rude specimens
1 portion of bone knife
1 cylindrical bone awl with broken tip
1 incised walrus bone harpoon
1 bone harpoon showing scratches made when object was in process

5 awl points
1 polished cylindrical awl
1 harpoon
1 bone gouge and scraper
1 broken awl point
1 barbed harpoon. Fine specimen
3 chipped bone implements
1 fragment of perforated human skull
1 perforated and inscribed bone
5 awls
1 spatulate implement, small
1 awl of bear's jaw with teeth
1 inscribed bone knife point
2 needles
1 semicarbonized bone knife point with incised marks
3 awl points
1 metatarsal bone
4 perforated and smoothed deer phalanges
1 panther claw
4 inscribed bone knives
2 long bone awls
3 harpoons
1 barbed harpoon
4 worked bones
2 flat awllike knives
3 worked antler points
8 rude awls
25 pieces of worked bone
3 fragments of bone knifes
4 awl points
1 Eskimoan awl
2 fragments of Eskimoan awls
2 rubbed and pointed bones
3 pieces worked walrus bone
4 antler points
8 bone beads of various sizes

BONE OBJECTS FROM PERCH RIVER

4 pieces of worked bone
1 piece of worked antler
16 bone awls of various sizes and forms
1 needle point
1 elk tooth pendant
10 pieces of worked bone
1 awl made from jaw of small rodent
1 bone knife fragment, Eskimoan
1 lot of sherds from Champlain
1 lot of worked bone
1 lot of pipe pottery from Duck Harbor
1 lot of pottery of Algonkin pattern

1 lot of animal bones
1 lot of pottery fragments from Perch river
1 lot of antler and bone objects
1 lot marked VII containing sherds
1 lot of Algonquin sherds
1 lot of animal bones
1 lot of potsherds from Rutland Hollow
1 lot of potsherds
1 lot of water-washed stones
1 lot of pipe pottery from St Lawrence county
7 articles of worked flint
5 bone awls
2 bear teeth
3 pitching tools
1 bone tube
5 specimens of worked stone
1 stone pick
1 rude celt
2 celts from Point Salubrious
2 celts from Perch river
1 stone cylinder
1 shell bead from ossuary
1 *busycon* cone bead
1 shell bead
16 triangular flint points
1 remnant of pottery coil which was bitten while soft by an Indian child when it was thrown into the fire and baked. Shows imprint of four lower incisors which were irregular.
1 pottery pipe, Perch river. Rare specimen

**Wienert, E.** Albany. 1 grooved axe of serpentine. Unusual form, from town of Duanesburg, Schenectady co.

### Collection

**Parker, Arthur C.**

FROM BURNING SPRING FORT, DURING THE SUMMER OF 1905

Fragments of pottery, arrow points, flint chips, bones and charcoal
Charred grass from grave
Arrow points
Bones, chips etc. from a pit on High Banks
10 fish net sinkers
12 celts or stone axes
8 pestles
14 stone articles (round) used perhaps as hammer stones
1 perforated stone
2 stones used perhaps for striking fire
1 scraper made of stone
Miscellaneous stone articles
Fragments of an earthenware pot

Fragments of pottery picked up on surface of Burning Spring site
1 cigar box containing flint objects: drills, scrapers, war points, hunting points, arrowheads etc.

FROM THE ERIE INDIAN VILLAGE, FORT AND BURIAL GROUND NEAR RIPLEY, CHAUTAUQUA CO., N. Y. DURING THE SUMMER AND AUTUMN OF 1906

STONE OBJECTS

1 stone mortar from ash pit 50
1 stone pipe, claw-shaped, from grave 105
1 stone pipe with stem, from grave 140
1 stone pipe with stem neck from grave 141
1 stone pipe bowl, Wisconsin form, from ash pit 26
1 oval stone pipe, Wisconsin form, from top soil. Trench 5
1 animal form pipe from grave 92
1 bar celt from grave 96
1 double edged celt from grave 92
1 celt from grave 132
1 celt from grave 100
4 celts found in fire pit 80
1 celt edge from ash pit 83
1 celt broken in process from trench 12
1 celt from grave 92
1 celt from grave 11
1 celt from knoll opposite site
1 rude celt from pit 32
1 small celt from ash pit 32
2 miniature celts edged from natural pebble. Ash pit 78
1 miniature celt edged from natural pebble. Ash pit 77
1 chisel-edged stone from ash pit 78
1 celt or edged stone from grave
10 triangular flint points from grave 139
4 triangular flint points from grave 117
10 triangular flint points from grave 120
8 triangular flint points from grave 96
6 triangular flint points from grave 94
1 long triangular flint from grave 78
1 triangular flint point from pit 78
1 yellow jasper triangular point from pit 55
2 flint triangular points from pit 50
8 flint triangular points from grave 63
5 flint triangular points from grave 64
7 triangular flint points from ash pit 32
4 triangular flint points from ash pit 34
4 triangular flint points from ash pits, various
1 flint perforator from grave 133
1 spear and 1 knife of flint from grave 133
3 flint scrapers from grave 133
5 flint chips from grave 133
1 flint knife from grave 139

1 translucent white spearhead from grave 120
2 flint knives from grave 120
1 translucent white spearhead from grave 120
1 black flint knife from grave 94
1 bunt point from ash pit 78
1 flint scraper from ash pit 50
1 flint knife from ash pit 35
1 flint blade from ash pit 21
1 oval blade from grave 10
1 flint object from grave
3 flint knives from grave 63
3 net sinkers from surface
1 hammer stone from trench 14
1 hammer stone from ash pit 83
1 hammer stone from ash pit 50
2 hammer stones from ash pit trench 3
1 worked stone from grave 63
1 worked stone from trench 18
1 grooved shaft rubbing stone from ash pit 83
1 worked stone from grave 120
1 chopper or digging stone from trench 12

POTTERY OBJECTS

1 pottery vessel from grave 140
1 pottery vessel from grave 119
1 large clay pot from grave
1 clay pot, corded decoration from grave 128
1 clay pot, corded decoration from grave 126
1 pottery vessel from grave
1 broken clay pot from grave 112
1 clay pot from grave 106
1 pottery vessel, wide mouth, from grave 100
1 clay pot with pitcher nose from grave 113
1 pottery vessel from grave
1 pottery vessel from grave 107
1 red clay pot from grave 105
1 small terra cotta vessel from grave 96
1 clay pot from grave 96
1 pottery cup from grave 96
1 pottery vessel from grave 87
1 pottery vessel from grave 88
1 pottery vessel from grave 92
1 pottery vessel from grave 86
1 pitcher-shaped pot from grave 69
1 pottery vessel and pipe from grave 62
1 clay pot from grave 62
1 pottery vessel from grave 65
1 pottery vessel from grave 51
1 pottery vessel from grave 48 (Restored)
1 small clay pot from ash pit 17

1 clay pot from grave 23
1 pottery vessel in fragments from grave 58
1 pottery vessel from trench 9
1 pottery vessel from grave 4
1 red terra cotta pipe, with nipple for stem, from grave 9
1 pottery pipe with a face on front and back, from grave 44
1 clay pipe from grave 51
1 terra cotta pipe bowl from ash pit 31
1 terra cotta pipe from grave 120
1 bear's head pipe bowl fragment from ash pit 82
1 pot rim fragment
3 pot points from pit 50
1 broken pot from grave 47
1 broken pot from grave 40
1 pot rim point from ash pit 42
1 potsherd with color band decorations from pit 33
2 pot points from ash pit 34
1 fabric-marked sherd from ash pit 32
2 pot points from ash pit 32
1 top of pipe bowl from surface
1 broken pipe bowl from trench 4
1 pipe bowl fragment from trench 11
1 fragment of pipe bowl, clay in process from trench 11
1 pipe stem from ash pit 74
1 trumpet-shaped pipe from grave 86
1 piece of pipe stem from surface

PIGMENTS

1 piece of black graphite from grave 133
2 pieces of black pigment from grave 120
1 lump of red pigment from grave 96

METALLIC OBJECTS

1 broken copper ring from grave 133
1 brass bead from grave 139
1 copper bead with section of original thong from grave 96
1 portion of copper arm band from ash pit 16
1 iron ax edge from grave 133
1 iron-stained stone from pit 32
1 rectangular iron bar from ash pit 32

ANTLER OBJECTS

1 pitching tool from grave 133
1 flaking tool from grave 133
1 anther punch from ash pit
1 antler hoe from ash pit 55
1 pitching tool from ash pit
1 antler implement with spatulate end from ash pit 50
1 pitching tool from ash pit 50
1 antler implement from ash pit 50

1 antler chisel from pit 16
1 hollowed antler punch from ash pit 79
1 antler spade or hoe from pit 21
1 antler chisel from pit 34
1 section of antler showing cutting from ash pit 38

BONE OBJECTS

3 bone awls from pit 84
1 bone awl from ash pit 79
5 bone awls from ash pit 74
4 bone awls from ash pit 75
1 tubular bone awl from ash pit 75
1 bone awl from ash pit 71
1 awl point from ash pit 70
1 awl from ash pit 70
3 awls from ash pit 50
2 rude awls from ash pit 46
1 large awl from ash pit 42
1 awl with broken tip from ash pit 42
1 awl from ash pit 35
1 bone needle fragment from pit 35
2 bone awls from pit 21
4 awls from pit 28
1 bone awl from ash pit 3
3 bone awls from ash pit 2
1 bone awl from ash pit 19
1 bone awl from ash pit 31
7 awls from ash pit 32
1 awl from ash pit 34
1 awl point from ash pit 38
2 tubular beads from ash pit 82
1 polished bone bead from pit 81
2 rude bone beads from ash pit 78
2 polished beads from ash pit 76
2 bone beads from pit 55
3 bone beads from ash pit 50
1 tubular bone bead from ash pit 46
8 bone beads from ash pit 86
1 broken bead from pit 45
1 short bead from ash pit 46
2 tubes of bone from ash pit 41
1 bone tube from ash pit 46
1 bone tube from ash pit 35
4 bone beads from ash pit 21
3 bone beads from ash pit in trench 1
5 bone beads from ash pit 28
6 bone beads from ash pit 3
1 bead

5 bone beads from ash pit 1
5 bone beads from ash pit 21
1 bone bead from ash pit 31
5 bone beads from ash pit 32
1 bone bead from ash pit 32
1 bone tube in process
1 bone bead from ash pit 53
1 smoothed deer's phalanx from ash pit 75
1 smoothed deer's phalanx from ash pit 76
4 smoothed deer's phalanges from ash pit 46
1 conical perforated phalanx from pit 34
1 portion of worked phalanx from ash pit 34
1 worked bone from ash pit 78
1 serrated rib from ash pit 78
1 long tube bead from ash pit 78
1 bone punch from ash pit 55
1 smoothed bone grooved on either side from ash pit 50
1 smoothed bone from ash pit 50
1 notched bone pendant from ash pit 21
1 bone shuttle from ash pit 29
1 fragment of tortoise shell cup, perforated, from ash pit 34
1 hollow handlelike bone from ash pit 34
1 bone plug from ash pit 32
1 worked bone from ash pit 38
1 worked deer phalanx from ash pit 79
1 smoothed phalanx from ash pit 74
1 scratched animal femur
4 incised bones from ash pit 38
1 perforated deer's tooth from ash pit 117
1 worked beaver tooth from ash pit 84
1 worked beaver tooth from ash pit 79
1 worked beaver tooth from ash pit 70
1 perforated elk's tooth from ash pit 55
1 tooth, perforated, from ash pit 50
1 bear tooth from ash pit 34
3 sections of a bone needle from ash pit 80
1 bone needle, broken, from ash pit 21
1 broken bone needle from ash pit 29
2 ear bones from "sheep-head" perch from ash pit 2
2 ear bones from "sheep-head" perch from ash pit 46
1 fish head game button from ash pit 77
1 polished racoon penis bone from ash pit 50

HUMAN REMAINS

Parts of 75 skeletons

OBJECTS OF SHELL

1 shell gorget found in grave 133
Various fragments of shell beads from grave 133

10 fragments of an incised shell from grave 133
50 discoidal beads found about neck of skeleton 133
1 shell pendant from grave 133
1 perforated unio shell from ash pit 46
1 discoidal bead from ash pit 21
1 shell bead from ash pit 3
50 snail shells, (Helix alternata) from pit

OBJECTS OF WOOD OR OTHER VEGETABLE SUBSTANCES

1 section of pipe stem preserved by carbonization
1 charred corn cob from ash pit 81
Decayed wood from grave 11
Quantity of charred corn from ash pit 32

MISCELLANEOUS

Objects from ash pits; 10 boxes

OTHER ARCHEOLOGICAL SPECIMENS COLLECTED IN THE FIELD 1906

1 pot rim fragment from Rochester Junction
1 celt in process from mouth of Cattaraugus
1 grooved ax from Burning Spring trail
1 notched flint point from Burning Spring trail. Rare form
1 pitted stone from Brant sand hill
5 potsherds from Burning Spring
1 piece of stone gorget from mouth of Cattaraugus creek
1 flint drill from mouth of Cattaraugus
1 triangular flint point from mouth of Cattaraugus
1 fragment of pipe stem
3 shouldered flints from mouth of Cattaraugus
1 flint drill from Burning Spring
1 yellow jasper flake from mouth of Cattaraugus
1 triangular blade from mouth of Cattaraugus
1 greenish yellow chip from mouth of Cattaraugus
1 perforated triangular arrow point of brass from Rochester Junction

Total ..... 3495+

X

# Appendix A

## NEW ENTRIES ON GENERAL RECORD OF LOCALITIES OF AMERICAN PALEOZOIC FOSSILS BELONGING TO STATE MUSEUM

### Alphabetic list of localities

Alfred (Allegany co.), 3528
Almond (Allegany co.), 3530
Aurelius (Cayuga co.), 3521
Aurora (Cayuga co.), 3506
Birch point, Me., 3543
Breakneck creek (Schuyler co.), 3507, 3508
Carlo's island, Me., 3538, 3539
Charles Mix county, S. D., 3513
Chatham (Tioga co.), Pa., 3531
Cincinnati, O., 3496
Collingwood, Ontario, Can., 3515
Cross Roads (Cayuga co.), 3516
Denbow point, Me., 3552
Dennysville, Me., 3549
Eastport, Me., 3542
East Rochester (Monroe co.), 3500
Edmunds, Me., 3550
Falls point, Me., 3548
Genesee river (Monroe co.), 3519, 3522, 3524
Genoa (Cayuga co.), 3503, 3505
Jerusalem Hill (Herkimer co.), 3525
Keneyville (Tioga co.), Pa., 3532
Knowlton's Landing, Me., 3555
Lebanon, O., 3512
Little river, Me., 3541
Lodi (Seneca co.), 3510
Lodi creek (Seneva co.), 3510
Lodi glen (Seneca co.), 3509
Lodi point (Seneca co.), 3504
Mazon creek (Grundy co.), Ill., 3511
Memphremagog lake, Quebec, Can. 3554, 3555
Moose island, Me., 3535, 3536, 3537, 3551
Naples (Ontario co.), 3502
North Hector (Schuyler co.), 3507, 3508
North Litchfield (Herkimer co.), 3534
Oakwood (Cayuga co.), 3517
Olean (Cattaraugus co.), 3529
Ontario, Can., 3514
Otisville (Orange co.), 3526
Owl's Head landing, Me., 3554
Parrish gully (Ontario co.), 3502
Payne's creek (Cayuga co.), 3506
Pembroke, Me., 3547, 3548
Pennamaguan bay, Me., 3544
Perry, Me., 3542
Pigeon hill, Me., 3542
Pittsford (Monroe co.), 3523
Pleasant point, Me., 3540
Rochester (Monroe co.), 3499, 3501, 3518, 3519, 3520, 3522, 3524
Rogus island, Me., 3553
Salmon creek (Cayuga co.), 3503, 3505
South Greece (Monroe co.), 3495
South Westerlo (Albany co.), 3498
"Spring House" (Monroe co.), 3523
Stone river, Tenn., 3497
Valois (Schuyler co.), 3507, 3508
West Pembroke, Me., 3545, 3546

### New York localities according to counties

Names in italics are new to the record.

ALBANY CO.
South Westerlo
ALLEGANY CO.
Alfred
Almond
CATTARAUGUS CO.
Olean
CAYUGA CO.
*Aurelius*
Aurora
*Cross Roads*
Genoa
*Oakwood*
*Payne's creek*
Salmon creek
DELAWARE CO.
Delhi
HERKIMER CO.
Jerusalem Hill
North Litchfield
MONROE CO.
East Rochester
Genesee river
Pittsford
Rochester
*South Greece*
"Spring House"
ONTARIO CO.
Naples
Parrish gully
ORANGE CO.
*Otisville*
SCHUYLER CO.
*Breakneck creek*
North Hector
Valois
SENECA CO.
Lodi
Lodi creek
Lodi glen
Lodi point
TOMPKINS CO.
Ithaca

## Index to formations



## Record of new localities

3495 Rochester shale. Excavation for barge canal 2 miles east of South Greece railroad station, Monroe co. H. C. Wardell, coll. 1905

3496 Upper Siluric. Cincinnati, O. Dr Fr. Coppi purchase, 1906.

3497 Trenton group. Stone river, Tenn. Dr Fr. Coppi purchase, 1906

3498 Hamilton beds. South Westerlo, N. Y. Ross Morehouse, donor, 1906

3499 Guelph dolomite. Excavation for new high school, Rochester, N. Y. C. A. Hartnagel, donor, 1906

3501 Upper Clinton. Genesee gorge, Rochester, N. Y. C. A. Hartnagel, donor, 1906

3502 Cashaqua beds. Parrish gully, Naples, N. Y. D. D. Luther, coll. 1905

3503 Genesee beds, top of. 3 miles south of Genoa on Salmon creek, Cayuga co., N. Y. D. D. Luther, coll. 1905

3504 Lower Portage beds. North ravine at Lodi point, Seneca lake, N. Y. 780′ A. T. D. D. Luther, coll. 1905

3505 Genesee beds, top of. 2½ miles south of Genoa village, N. Y. at the forks of Salmon creek near an old mill. D. D. Luther, coll. 1905

3506 Ludlowville shale. Aurora, N. Y. Payne's creek at about 420′ A. T. 50 to 100 feet below Tichenor limestone. D. D. Luther, coll. 1905

3507 Portage beds. Valois (North Hector) N. Y. at 600 ft A. T. in Breakneck creek ravine. Horizon 175 ft (est.) above base of the Portage. D. D. Luther, coll. 1905

3508 Portage beds. Valois (North Hector) N. Y. In Breakneck creek ravine at 540′ A. T. Horizon 120 ft (est.) above base of Portage. D. D. Luther, coll. 1905

3509 Portage beds. Lodi Glen, 800 to 820 ft A. T. D. D. Luther, coll. 1905

3510 Hatch shale. Lodi creek 1 mile south of Lodi village at 1050′ A. T. D. D. Luther, coll. 1905

3511 Upper Carbonic. Mazon creek, Grundy co., Ill. Dr F. Krantz, purchase, 1906

3512 Richmond beds. Lebanon, O. Ward's Natural Science Establishment, purchase, 1906

3513 Drift (Siluric ?). Charles Mix county, S. D. Ward's Natural Science Establishment, purchase, 1906

3514 Trenton group. Ontario, Can. Ward's Natural Science Establishment, purchase, 1906

3515 Trenton group. Collingwood, Ontario, Can. Ward's Natural Science Establishment, purchase, 1906

3516 Bertie waterlime. Cross Roads, Cayuga co., N. Y. C. A. Hartnagel, coll. 1901–5

3517 Onondaga limestone. Cliff north of Oakwood, Cayuga co., N. Y. C. A. Hartnagel, coll. 1901–5

3518 Rochester shale. Rochester, N. Y. C. A. Hartnagel, coll. 1901–5

3519 Clinton beds (lower limestone). Genesee river, Rochester, N. Y. C. A. Hartnagel, coll. 1901–5

3520 Clinton beds (top of lower green shale). Rochester, N. Y. C. A. Hartnagel, coll. 1901–5

3521 Cobleskill limestone. Stony Pitch near Aurelius, Cayuga co., N. Y. C. A. Hartnagel, coll. 1901–5

3522 Lockport dolomite. Brink of upper falls Genesee, river, Rochester, N. Y. C. A. Hartnagel, coll. 1901–5

3523 Salina beds, base of. "Spring House" Pittsford, N. Y. R. Ruedemann & H. C. Wardell, coll. 1906

3524 Clinton beds. Genesee gorge, Rochester, N. Y. H. C. Wardell, coll. 1906

3525 Bertie limestone. Maxwell's farm, Jerusalem Hill, Herkimer co., N. Y. H. C. Wardell, coll. 1906

3526 Shawangunk grit. Erie R. R. crusher quarry, Otisville, N. Y. H. C. Wardell, coll. 1906

3527 Wolf creek conglomerate. Cattaraugus co., N. Y. Charles Butts, coll.

3528 Chemung beds. Alfred, N. Y. Charles Butts, coll.

3529 Chemung beds. Olean, N. Y. Charles Butts, coll.

3530 Chemung beds. Almond, N. Y. Charles Butts, coll

3531 Chemung beds. Chatham, Tioga co., Pa. Charles Butts, coll.

3532 Chemung beds. Keneyville, Tioga co., Pa. Charles Butts, coll.

3533 Kinzua sandstone. Tioga co., Pa. Charles Butts, coll.

3534 Helderbergian. Salisbury's quarry, North Litchfield, Herkimer co., N. Y. H. C. Wardell, coll. 1906

3535 ..... Prince or Salt works cave southwest side of Moose island, Washington co., Me. O. O. Nylander, coll. 1906

3536 ..... Point just south of Broad cove, west side of Moose island, Washington co., Me. O. O. Nylander, coll. 1906

3537 ..... Shackford head north side of Broad cove, Moose island, Washington co., Me. O. O. Nylander, coll. 1906

3538 ..... North part Carlo's island, St Croix river, Washington co., Me. O. O. Nylander, coll. 1906

3539 ..... Southwest part of Carlo's island, St Croix river, Washington co., Me. O. O. Nylander, coll. 1906

3540 ..... Pleasant point, Washington co., Me. O. O. Nylander, coll. 1906

3541 ..... Mouth of Little river (west side), Washington co., Me. O. O. Nylander, coll. 1906

3542 ..... Pigeon hill, between Perry and Eastport, Washington co., Me. O. O. Nylander, coll. 1906

3543 ..... Birch point, extreme southern point of the town of Perry, Washington co., Me. O. O. Nylander, coll. 1906

3544 ..... West side of the head of Pennamaguan bay, Washington co., Me. O. O. Nylander, coll. 1906

3545 ..... Farm of G. Hilton. 3 miles south of West Pembroke, Washington co., Me. O. O. Nylander, coll. 1906

3546 ..... On farms of Ezra Leighton and Isaac Leighton, 4 miles south of West Pembroke, Washington co., Me. O. O. Nylander, coll. 1906

3547 ..... Schooner cove (east side), town of Pembroke, Washington co., Me. O. O. Nylander, coll. 1906

3548 ..... Falls point, extreme southern point of town of Pembroke, Washington co., Me. O. O. Nylander, coll. 1906

3549 ..... King David's lodge. Town of Dennysville, Washington co., Me. O. O. Nylander, coll. 1906

3550 ..... On farm of Joseph Bell. Southwestern part of town of Edmunds, Washington co., Me. O. O. Nylander, coll. 1906

3551 ..... Northern end of Moose island, Washington co., Me. O. O. Nylander, coll. 1906

3552 ..... Denbow point, northern point of town of Lubec, Washington co., Me. O. O. Nylander, coll. 1906

3553 ..... Rogus island, town of Lubec, Washington co., Me. O. O. Nylander, coll. 1906

3554 Devonic limestone. Cove at Owl's Head landing, Memphremagog lake, Quebec, Can. R. Ruedemann, coll. 1906

3555 Devonic shale. Grove creek, 1 mile west of Knowlton's Landing, Memphremagog lake, Quebec, Can. R. Ruedemann, coll. 1906

## Record of foreign localities

Specimens bearing lemon yellow tickets

162 Upper Siluric. Konieprus, Bohemia. Fr. Coppi, purchase

163 Upper Siluric. Bohemia. Fr. Coppi, purchase

164 Upper Siluric. Tetin, Bohemia. Fr. Coppi, purchase

165 Upper Siluric. Dlouha hora, Bohemia. Fr. Coppi, purchase

166 Upper Siluric. Lochkow, Bohemia. Fr. Coppi, purchase

167 Lower Siluric. Vesela, Bohemia. Fr. Coppi, purchase

168 Lower Siluric. Bohemia. Fr. Coppi, purchase

169 Lower Siluric. Andrarum, Sweden. Fr. Coppi, purchase

170 Upper Siluric. Kolednik, Bohemia. Fr. Coppi, purchase

171 Lower Siluric. Oeland, Sweden. Fr. Coppi, purchase

172 Upper Siluric. Gotland, Sweden. Fr. Coppi, purchase

173 Upper Siluric. Wenlock limestone. Dudley, England. Fr. Coppi, purchase

174 Lower Siluric. Zahoran, Bohemia. Fr. Coppi, purchase
175 Silurian (schiste ardoisier). Trélazé, near Angers, France. Fr. Coppi, purchase
176 Upper Siluric. St Ivan, Bohemia. Fr. Coppi, purchase
177 Siluric. Vaques, Calvados, France. Fr. Coppi, purchase
178 Lower Devonic. Bundenbach, Rhenish Pr. F. Krantz, purchase
179 Lower Siluric. Christiania, Norway. F. Krantz, purchase
180 Cambric. Skrey, Bohemia. F. Krantz, purchase
181 Lower Siluric. Pulkowka river, Kusmino near St Petersburg, Russia. F. Krantz, purchase
182 Cambric. Skrey, Bohemia. F. Krantz, purchase
183 Siluric. Leitschkow, Bohemia. F. Krantz, purchase
184 Upper Cambric. Skrey, Bohemia. F. Krantz, purchase
185 Middle Devonic. Terques, Pas de Calais, Fr. Jean Miguel, exchange
186 Upper Devonic. S. Nazaire, Hérault, Fr. Jean Miguel, exchange
187 Middle Devonic. Trasmiers, Terques Pas de Calais, France. Jean Miguel, exchange
188 Lower Devonic. Nehou, Manche, France. Jean Miguel, exchange
189 Lower Devonic. La Baconnière, Mayenne, France. Jean Miguel, exchange.
190 Middle Devonic (Eifelian). Le Mont Peyoux, Herault, France Jean Miguel, exchange
191 Upper Devonic. Cabrières, Herault, France. Jean Miguel, exchange
192 Lower Devonic. S. Germain le Touilly, Fr. Jean Miguel, exchange
193 Carbonic. Dudley, England. F. Krantz, purchase
194 Upper Siluric. Hostin, Bohemia. F. Krantz, purchase
195 Upper Siluric. Dudley, England. F. Krantz, purchase
196 Siluric. Bala, Northern Wales. F. Krantz, purchase
197 Siluric. Kuchelbad, Bohemia. F. Krantz, purchase
198 Lower Siluric. Mortain, France. F. Krantz, purchase
199 Carbonic. Eskdale, New Brunswick. F. Krantz, purchase
200 Upper Siluric. Rötziküll, Island of Oesel, Livland, Russia. F. Krantz, purchase
201 Lower Siluric. County Tyrone, Ireland. F. Krantz, purchase
202 Lower Siluric. Ostergotland, Sweden. F. Krantz, purchase
203 Upper Siluric. Gotland, Sweden. F. Krantz, purchase
204 Upper Siluric. Lodenitz, Bohemia. F. Krantz, purchase
205 Lower Siluric. Vitré Ille et Vilaine, France. F. Krantz, purchase
206 Lower Devonic. Winnigen on the Moselle, Rhenish Prussia. F. Krantz, purchase
207 Lower Siluric. Girvan, Scotland. F. Krantz, purchase
208 Siluric. Dudley, England. F. Krantz, purchase
209 Lower Coblentz. Oberstadtfeld, Germany. Fr. Drevermann, donor
210 Middle Devonic. Pelm, Eifel, Germany. Fr. Drevermann, donor
211 Lower Coblentz. Singhofen, Germany. Fr. Drevermann, donor
212 Middle Devonic. Ahrhütte, Eifel, Ger. Fr. Drevermann, donor
213 Middle Devonic. Lissingen, Germany. Fr. Drevermann, donor
214 Middle Devonic. Gerolstein, Germany. Fr. Drevermann, donor
215 Middle Devonic. Gondelsheim, Eifel, Ger. Fr. Drevermann, donor
216 Middle Devonic. Schmidtheim, Eifel, Ger. Fr. Drevermann, donor

217 Middle Devonic. Auburg, Eifel, Germany. Fr. Drevermann, donor
218 Siluric. Lion, Loire Inferieure, France. F. Krantz, purchase
219 Siluric. Saille, Ille et Vilaine, France. F. Krantz, purchase
220 Siluric. St Chinian, Herault, France. F. Krantz, purchase
221 Siluric. Travenzot, Sarthe, France. F. Krantz, purchase
222 Siluric. Guichen, Ille et Vilaine, France. F. Krantz, purchase
223 Precambric. Oeland, Sweden. F. Krantz, purchase
224 Cambric. Herault, France. F. Krantz, purchase
225 Lower Devonic. Bundenbach, Rheinland, Ger. F. Krantz, purchase
226 Cambric. Tremadoc. North Wales, Eng. F. Krantz, purchase
227 Siluric. May, France. F. Krantz, purchase
228 Lower Devonic. Stadfeld, Daun, Eifel, Rhenish Prussia. F. Krantz, purchase
229 Siluric. Dudley, England. F. Krantz, purchase
230 Carbonic. Clitheroe, Lancaster, England. F. Krantz, purchase
231 Lower Siluric. Osek, Bohemia. F. Krantz, purchase
232 Lower Siluric. Sadewitz, Silesia, Germany. F. Krantz, purchase
233 Siluric. Lodewitz, Bohemia. F. Krantz, purchase
234 Hercynian. Konieprus, Bohemia. F. Krantz, purchase
235 Devonic. Herault, France. F. Krantz, purchase
236 Siuric. St Benigne, Bohemia. F. Krantz, purchase
237 Lower Siluric. Beraun, Bohemia. F. Krantz, purchase
238 Devonic fossils from Tibagy, Paraná, Brazil. I. C. White, donor
239 Devonic fossils. Jaguaryhiva, Paraná, Brazil. I. C. White, donor
240 Devonic fossils. Ponta Grossa, Paraná, Brazil. I. C. White, donor
241 Devonic Fossils. Near Pará, Brazil. I. C. White, donor
242 Upper Siluric. Lodewitz, Bohemia. F. Krantz, purchase
243 Siluric. Dudley, England. F. Krantz, purchase
244 Lower Siluric. Podcaple, Bohemia. F. Krantz, purchase
245 Siluric. Lodewitz, Bohemia. F. Krantz, purchase
246 Hercynian. Koniéprus, Bohemia. F. Krantz, purchase
247 Lower Devonic. Maecurú river, Pará, Brazil. Morgan expedition collection. O. A. Derby & J. M. Clarke, donors
248 Middle Siluric. Rio Trombetas, Pará, Brazil. Morgan expedition collection. O. A. Derby & J. M. Clarke, donors
249 Lower Devonic. Rio Curuá, Pará, Brazil. Morgan expedition collection. O. A. Derby & J. M. Clarke, donors
250 Lower Devonic. Ereré, Pará, Brazil. Morgan expedition collection. O. A. Derby & J. M. Clarke, donors
251 Devonic. Ponta Grossa. State of Paraná, Brazil. Morgan expedition collection. O. A. Derby & J. M. Clarke, donors
252 Devonic (?) Colonia Thereza, State of Paraná, Brazil. Morgan expedition collection. O. A. Derby & J. M. Clarke, donors
253 Coal Measures. Itaitubá, Brazil. Morgan expedition collection. O. A. Derby & J. M. Clarke, donors
254 Triassic (?) Piracicaba. State of São Paulo, Brazil. O. A. Derby & J. M. Clarke, donors

# Appendix B

CATALOGUE OF

## TYPE SPECIMENS OF PALEOZOIC FOSSILS

### Supplement 3

The general classified list, covering 5159 numbers, was published as Museum bulletin 65. Supplement 1 was published as part of the annual report of the Paleontologist 1903. Supplement 2 was published as part of the report of the Director 1904.

### PLANTAE

ARTHROPHYCUS Hall

**Arthrophycus harlani** Conrad (sp.)

6176 $\frac{1\,2\,0}{3}$ HYPOTYPE Derby. Arch. do Mus. Nac. do Rio de Janeiro. 1879. 2:92.

Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. facing p. 4.

Siluric. Oiteiro do Cachorra, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

### COELENTERATA

#### SPONGIAE

**Hexactinellid sponge** (spicules of)

6177 $\frac{2\,3\,1\,0}{1}$ HYPOTYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 4, pl. 1, fig. 23.

Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J M. Clarke, donors

6178 $\frac{2\,3\,1\,0}{2}$ HYPOTYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 1, fig. 24.

Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

#### CNIDARIA

ALVEOLITES Lamarck

**Alveolites goldfussi** Billings

6179 $\frac{3\,0\,2\,1}{1}$ HYPOTYPE Billings. Canadian Journal. n. s. 1860. 5:255.

Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 14, fig. 5, 8.

Hamilton beds. York, Livingston co. N. Y.
C. Van Deloo, coll. 1865

6180 $\frac{30\,2\,1}{2}$ HYPOTYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 14, fig. 6, 7, 9.

Hamilton beds.
Norton's landing, Cayuga lake, N. Y.
H H. Smith, coll. 1871

Astrea stylopora *see* Michelinia (Pleurodictyum) stylopora

Calamopora hemisphericus *see* Favosites hemisphericus

Calamopora maxima *see* Michelinia (Pleurodictyum) maxima

CHAETETES Fischei

**Chaetetes fruticosus** Hall

6181 $\frac{31\,4\,3}{1}$ TYPE Chaetetes fruticosus Hall. Illustrations of Devonian fossils. 1876. Corals, explanation of pl. 38; pl. 38, fig. 1.

Hamilton beds Canandaigua lake, N. Y.
R. P. Whitfield & J. W. Hall, coll. 1858

6182 $\frac{31\,4\,3}{2}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 38, fig 2, 4.

Hamilton beds Canandaigua lake, N. Y.
R. P. Whitfield & C. Van Deloo, coll. 1862

6183 $\frac{31\,4\,3}{3}$ TYPE Hall. Illustrations of Devonian Fossils. 1876. Corals, pl. 38 fig 5.

Hamilton beds Western New York

**Chaetetes furcatus** Hall

6184 $\frac{31\,4\,4}{1}$ TYPE Chaetetes furcatus Hall. Illustrations of Devonian fossils. 1876. Corals, explanation of pl. 37; pl. 37, fig. 1, 3. (Part of specimen)

Hamilton beds
Norton's landing, Cayuga lake, N. Y.
H. H. Smith, coll. 1871

6185 $\frac{3144}{2}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 37, fig. 2, 4.
Hamilton shale
Norton's landing, Cayuga lake, N. Y.
H. H. Smith, coll. 1871

6186 $\frac{3144}{3}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 37, fig. 5.
Hamilton beds
Norton's landing, Cayuga lake, N. Y.

6187 $\frac{3144}{4}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 38, fig. 7.
Hamilton beds Bellona, Yates co. N. Y.
C. A. White & C. Van Deloo, coll. 1860

**Chaetetes humilis** Hall

6188 $\frac{3145}{1}$ TYPE Chaetetes humilis Hall. Illustrations of Devonian fossils. 1876. Corals, explanation of pl. 37; pl. 37, fig. 11, 12.
Onondaga limestone Western New York

6189 $\frac{3145}{2}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 37, fig. 13, 14.
Onondaga limestone Western New York

6190 $\frac{3145}{3}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 37, fig. 15.
Onondaga limestone Western New York

**Chaetetes tenuis** Hall

6191 $\frac{3146}{1}$ HYPOTYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 37, fig. 9, 10.
Onondaga limestone Stafford, Genesee co. N. Y.

CYSTIPHYLLUM Lonsdale

**Cystiphyllum americanum** Milne-Edwards & Haime

6192 $\frac{3281}{1}$ HYPOTYPE Milne-Edwards & Haime. Polyp. Foss. Terr. Palaeozoiques. 1851. p. 464.
Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 28, fig. 2.
Hamilton beds West Williams, Ont.
J. De Cew, coll. 1865

6193 $\frac{3\,2\,8\,1}{2}$ HYPOTYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 28, fig. 5.
Hamilton beds West Williams, Ont.
J. De Cew, coll. 1865

**Cystiphyllum conifollis** Hall

6194 $\frac{3\,2\,8\,2}{1}$ TYPE Cystiphyllum conifollis Hall. Illustrations of Devonian fossils. 1876. Corals, explanation of pl. 30; pl. 30, fig. 3.
Hamilton beds West Williams, Ont.
J. De Cew, coll. 1865

**Cystiphyllum varians** Hall

6195 $\frac{3\,2\,8\,0}{5}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 29, fig. 6.
Hamilton beds. Moscow, Livingston co. N. Y.
C. Van Deloo, coll. 1865

6196 $\frac{3\,2\,8\,0}{6}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 29, fig. 7–9.
Hamilton beds York, Livingston co. N. Y.
C. A. White & C. Van Deloo, coll. 1860

FAVOSITES Lamarck

**Favosites arbusculus** Hall

6197 $\frac{3\,4\,2\,0}{2}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 36, fig. 2.
Hamilton beds Moscow, Livingston co. N. Y.
C. Van Deloo, coll. 1865

6198 $\frac{3\,4\,2\,0}{3}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 36, fig. 3.
Hamilton beds York, Livingston co. N. Y.
C. Van Deloo, coll. 1865

6199 $\frac{3\,4\,2\,0}{4}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 36, fig. 4.
Hamilton beds York, N. Y.
C. Van Deloo, coll. 1865

6200 $\frac{3\,4\,2\,0}{5}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 36, fig. 6.
Hamilton beds York, N. Y.
C. Van Deloo, coll. 1865

5201 $\frac{34206}{}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 36, fig. 8

Hamilton beds York, N. Y.

C. Van Deloo, coll. 1865

**Favosites ? argus** Hall

5202 $\frac{34251}{}$ TYPE Favosites ? argus Hall. Illustrations of Devonian fossils. 1876. Corals, explanation of pl. 13; pl. 13, fig. 1.

Hamilton beds York, N. Y.

C. Van Deloo, coll. 1865

5203 $\frac{34252}{}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 13, fig. 2.

Hamilton beds Darien, Genesee co. N. Y.

C. A. White & C. Van Deloo, coll. 1860–61

5204 $\frac{34253}{}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 13, fig. 3.

Hamilton beds York, Livingston co. N. Y.

C. Van Deloo, coll. 1865

5205 $\frac{34254}{}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 13, fig. 5, 7.

Hamilton beds York, N. Y.

C. A. White & C. Van Deloo, coll. 1860

5206 $\frac{34255}{}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 13, fig. 6.

Hamilton beds Bellona, Yates co. N. Y.

J. W. Hall & C. Van Deloo, coll. 1866

5207 $\frac{34256}{}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 13, fig. 8.

Hamilton beds York, N. Y.

C. Van Deloo, coll. 1865

5208 $\frac{34257}{}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 13, fig. 9.

Hamilton beds York, N. Y.

C. Van Deloo, coll. 1865

**Favosites emmonsi** Hall

6209 $\frac{34261}{1}$ **TYPE** Favosites emmonsi Hall. Illustrations of Devonian fossils. 1876. Corals, explanation of pl. 9; pl. 9, fig. 1.
Onondaga limestone Cayuga, Ontario, Can.
J. De Cew, coll. 1866

6210 $\frac{34261}{2}$ **TYPE** Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 9, fig. 2.
Onondaga limestone Ontario, Can.
J. De Cew, coll. 1866

6211 $\frac{34261}{3}$ **TYPE** Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 9, fig. 3, 4.
Onondaga limestone Williamsville, Erie co. N. Y
R. P. Whitfield, C. A. White & C. Van Deloo, coll. 1860

6212 $\frac{34261}{4}$ **TYPE** Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 9, fig. 5.
Onondaga limestone Falls of the Ohio
R. P. Whitfield, coll. 1865

6213 $\frac{34261}{5}$ **TYPE** Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 9, fig. 6.
Onondaga limestone Falls of the Ohio
R. P. Whitfield, coll. 1865

6214 $\frac{34261}{6}$ **TYPE** Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 11, fig. 5.
Onondaga limestone Ontario, Can.
J. De Cew, coll. 1866

6215 $\frac{34261}{7}$ **TYPE** Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 12, fig. 4.
Onondaga limestone Falls of the Ohio

6216 $\frac{34261}{8}$ **TYPE** Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 12, fig. 5.
Onondaga limestone Williamsville, Erie co. N. Y.
C. A. White, coll. 1860

**Favosites epidermatus** Rominger

6217 $\frac{34271}{1}$ **HYPOTYPE** Favosites epidermatus Rominger. American Journal of Science. 1862. 34:396.

Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 6, fig. 3, 4.

Onondaga limestone Ontario, Can.
J. De Cew, coll. 1866

6218 $\frac{34}{2}\frac{27}{}$ HYPOTYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 6, fig. 5.

Onondaga limestone
Caledonia, Livingston co. N. Y.
C. A. White, coll. 1860

6219 $\frac{34}{3}\frac{27}{}$ HYPOTYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 12, fig. 9.

Onondaga limestone Ontario, Can.
J. De Cew, coll. 1866

**Favosites epidermatus** Rominger *var.* **corticosus** Hall

6220 $\frac{34}{1}\frac{28}{}$ TYPE Favosites epidermatus var. corticosus Hall. Illustrations of Devonian fossils. 1876. Corals, explanation of pl. 10; pl. 10, fig. 1.

Onondaga limestone Western New York

6221 $\frac{34}{2}\frac{28}{}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 10, fig. 6.

Onondaga limestone Ontario, Can.
J. De Cew, coll. 1866

**Favosites (Michelinia?) explanatus** Hall

6222 $\frac{34}{1}\frac{29}{}$ TYPE Favosites (Michelinia?) explanatus Hall. Illustrations of Devonian fossils. 1876. Corals, explanation of pl. 14; pl. 14, fig. 1–4.

Hamilton beds York, Livingston co. N. Y.
C. Van Deloo, coll. 1865

**Favosites hamiltonensis** Hall

6223 $\frac{34}{1}\frac{29a}{}$ TYPE Favosites hamiltonensis Hall. Illustrations of Devonian fossils. 1876. Corals, explanation of pl. 34; pl. 34, fig. 1, 2.

Hamilton beds Aurora, Cayuga co. N Y.
G. B. Simpson, coll. 1863

6224 $\frac{34}{2}\frac{29a}{}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 34, fig. 4.

Hamilton beds Aurora, N. Y.
G. B. Simpson, coll. 1863

6225 $\frac{34\,2\,9a}{3}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 34, fig. 5.
Hamilton beds Aurora, N. Y.
G. B. Simpson, coll. 1863

6226 $\frac{34\,2\,9a}{4}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 34, fig. 8.
Hamilton beds Aurora, N. Y.
G. B. Simpson, coll. 1863

6227 $\frac{34\,2\,9a}{5}$ TYPE Hall. Illustrations of Devonian fossils. 1876 Corals, pl. 34, fig. 9.
Hamilton beds Aurora, N. Y.
G. B. Simpson, coll. 1863

**Favosites hemisphericus** Troost (sp.)

6228 $\frac{34\,2\,9b}{1}$ HYPOTYPE Calamopora hemispherica Troost. Fifth Geological Report of Tennessee. 1840. p. 72.
Favosites hemisphericus Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 11, fig. 6.
Onondaga limestone Falls of the Ohio
R. P. Whitfield, coll. 1865

**Favosites hemisphericus** Troost *var.* **a** Hall

6229 $\frac{34\,2\,9c}{1}$ TYPE Favosites hemisphericus var. a Hall. Illustrations of Devonian fossils. 1876. Corals, explanation of pl. 2A; pl. 2A, fig. 6.
Onondaga limestone Falls of the Ohio
S. S. Lyon, coll.

6230 $\frac{34\,2\,9c}{2}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 2A, fig. 7.
Onondaga limestone Falls of the Ohio
R. P. Whitfield, coll. 1865

**Favosites hemisphericus** Troost *var.* **distortus** Hall

6231 $\frac{34\,2\,9d}{1}$ TYPE Favosites hemisphericus var. distortus Hall. Illustrations of Devonian fossils. 1876. Corals, explanation of pl. 5; pl. 5, fig. 1.
Onondaga limestone Schoharie co. N. Y.
J. Gebhard jr purchase, 1872

**Favosites hemisphericus** Troost *var.* **rectus** Hall

6232 $\frac{34296}{1}$ **TYPE** Favosites hemisphericus var. rectus Hall. Illustrations of Devonian fossils. 1876. Corals, explanation of pl. 2C; pl. 2C, fig. 1, 2.
Onondaga limestone Ontario, Can.
J. De Cew, coll. 1866

6233 $\frac{34296}{2}$ **TYPE** Hall. Illustrations of Devonian Fossils. 1876. Corals, pl. 2C, fig. 3, 4.
Onondaga limestone Ontario, Can.
J. De Cew, coll. 1866

**Favosites hemisphericus** *var.* **turbinatus** Billings

6234 $\frac{34296}{1}$ **HYPOTYPE** Favosites turbinatus Billings. Canadian journal. n. s. 1859. 4: 109.
Favosites hemisphericus var. turbinatus Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 2C, fig. 5.
Onondaga limestone Falls of the Ohio
R. P. Whitfield, coll. 1865

6235 $\frac{34296}{2}$ **HYPOTYPE** Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 11, fig. 2, 3.
Onondaga limestone Columbus, O.
R. P. Whitfield, coll. 1865

6236 $\frac{34296}{3}$ **HYPOTYPE** Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 11, fig. 4.
Onondaga limestone Columbus, O.
R. P. Whitfield, coll. 1865

**Favosites placenta** Rominger

6237 $\frac{34296}{1}$ **HYPOTYPE** Favosites placenta Rominger. Fossil corals. 1876. p. 34.
Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 35, fig. 3, 10, 11.
Hamilton beds York, Livingston co. N. Y.
C. A. White & C. Van Deloo, coll. 1860

6238 $\frac{34296}{2}$ **HYPOTYPE** Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 35, fig. 4.
Hamilton beds York, N. Y.
C. A. White & C. Van Deloo, coll. 1860

6239 $\frac{3\,4\,2\,9\,g}{3}$ **HYPOTYPE** Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 35, fig. 5.
Hamilton beds York, N. Y.

6240 $\frac{3\,4\,2\,9\,g}{4}$ **HYPOTYPE** Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 35, fig. 6–9, 12.
Hamilton beds Western New York

**Favosites tuberosus** Rominger

6241 $\frac{3\,4\,2\,h}{1}$ **HYPOTYPE** Favosites tuberosus Rominger. Fossil corals. 1876. p. 31.
Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 8, fig. 2.
Onondaga limestone Cayuga, Ontario, Can.
J. De Cew, coll. 1866

6242 $\frac{3\,4\,2\,9\,h}{2}$ **HYPOTYPE** Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 12, fig. 7.
Onondaga limestone Ontario, Can.
J. De Cew, coll. 1866

Favosites turbinatus *see* Favosites hemisphericus *var.* turbinatus

**Favosites ?** sp.

6243 $\frac{3\,4\,2\,9\,i}{1}$ **HYPOTYPE** Favosites ? sp. Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 13, fig. 3.
Hamilton beds York, Livingston co. N. Y.
C. Van Deloo, coll. 1865

6244 $\frac{3\,4\,2\,9\,i}{2}$ **HYPOTYPE** Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 13, fig. 11.
Hamilton beds York, N. Y.
C. Van Deloo, coll. 1865

**Heliophyllum** Hall

Heliophyllum exiguum *see* Heliophyllum (Zaphrentis) exiguum

**Heliophyllum (Zaphrentis) exiguum** Billings

6245 $\frac{3\,4\,4\,2}{1}$ **HYPOTYPE** Heliophyllum exiguum Billings. Canadian journal. n. s. 1860. 5:261.
Heliophyllum (Zaphrentis) exiguum

Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 32, fig. 1–3.

Onondaga limestone

Clarence hollow, Erie co. N. Y.

R. P. Whitfield, C. A. White & C. Van Deloo, coll. 1860

**Heliophyllum halli** Milne-Edwards & Haime

6246 $\frac{3443}{1}$ HYPOTYPE Heliophyllum halli Milne-Edwards & Haime. British Fossil corals. 1850. introd. p. 69.

Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 23 fig. 2.

Hamilton beds West Williams, Ontario, Can.

J. De Cew, coll. 1875

6247 $\frac{3443}{2}$ HYPOTYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 23, fig. 3.

Hamilton beds Moscow, Livingston co. N. Y.

C. Van Deloo, coll. 1865

Madrepora limbata *see* Striatopora (Thamnoptychia) limbata

MICHELINIA de Koninck

Michelinia convexa *see* Michelinia (Pleurodictyum) convexa

**Michelinia (Pleurodictyum) convexa** d'Orbigny

6248 $\frac{3561}{1}$ HYPOTYPE Michelinia convexa d'Orbigny. Prodrome de Palaeontologie. 1850. 1:107.

Michelinia (Pleurodictyum) convexa Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 15, fig. 2.

Onondaga limestone

6249 $\frac{3561}{2}$ HYPOTYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 15, fig. 3.

Onondaga limestone Ontario, Can.

J. De Cew, coll. 1866

6250 $\frac{3561}{3}$ HYPOTYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 15, fig. 4.

Onondaga limestone Cayuga, Ontario, Can.

J. De Cew, coll. 1866

6251 $\frac{3561}{4}$ HYPOTYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 15A, fig. 2.
Onondaga limestone Western New York
Pickett collection

6252 $\frac{3561}{5}$ HYPOTYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 15A, fig. 9.
Onondaga limestone Schoharie co. N. Y.
J. Gebhard jr purchase, 1872

6253 $\frac{3561}{6}$ HYPOTYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 15A, fig. 10.
Onondaga limestone

6254 $\frac{3561}{7}$ HYPOTYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 15A, fig. 11.
Onondaga limestone Falls of the Ohio
R. P. Whitfield, coll. 1865

**Michelinia (Pleurodictyum) dividua** Hall

6255 $\frac{3562}{1}$ TYPE Michelinia (Pleurodictyum) dividua Hall. Illustrations of Devonian fossils. 1876. Corals, explanation of pl. 18; pl. 18, fig. 10.
Hamilton beds York, Livingston co. N. Y.
C. Van Deloo, coll. 1865

6256 $\frac{3562}{2}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 18, fig. 11, 12.
Hamilton beds York, N. Y.
C. Van Deloo, coll. 1865

**Michelinia (Pleurodictyum) maxima** Troost (sp.)

6257 $\frac{3563}{1}$ HYPOTYPE Calamopora maxima Troost. Geological report of Tennessee. 1840. p. 73.
Michelinia (Pleurodictyum) maxima Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 16, fig. 1.
Onondaga limestone

**Michelinia (Pleurodictyum) stylopora** Eaton (sp.)

6258 $\frac{3564}{1}$ TYPE Astrea stylopora Eaton. Geological text book. 1832. p. 40.
Michelinia (Pleurodictyum) sty-

lopora Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 18, fig. 4.

Hamilton beds Skaneateles lake, N. Y.
J. W. Hall & G. B. Simpson, coll. 1872

STRIATOPORA Hall

**Striatopora (Thamnoptychia) limbata** Eaton (sp.)

6259 $\frac{3770}{1}$ HYPOTYPE Madrepora limbata Eaton. Geological text book. 1832. p. 39.

Striatopora (Thamnoptychia) limbata Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 33, fig. 13.

Hamilton beds York, Livingston co. N. Y.
C. A. White & C. Van Deloo, coll. 1860

TRACHYPORA Milne-Edwards & Haime

**Trachypora elegantula** Billings

6260 $\frac{3815}{1}$ HYPOTYPE Trachypora elegantula Billings. Canadian journal. n. s. 1860. 5: 254.

Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 33, fig. 3.

Hamilton beds Western New York

ZAPHRENTIS Rafinesque

**Zaphrentis halli** Milne-Edwards & Haime

6261 $\frac{3884}{2}$ HYPOTYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 20, fig. 2.

Hamilton beds Skaneateles lake, N. Y.
W. M. Gebhard, coll. 1857

6262 $\frac{3884}{3}$ HYPOTYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 20, fig. 3.

Hamilton beds Skaneateles lake, N. Y.
W. M. Gebhard, coll. 1857

6263 $\frac{3884}{4}$ HYPOTYPE Hall. Illustrations of Devonian fossils. 1876 Corals, pl. 20, fig. 4.

Hamilton beds Skaneateles lake, N. Y.
J. W. Hall & G. B. Simpson, coll. 1872

6264 $\frac{3884}{5}$ HYPOTYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 20, fig. 6.

Hamilton beds Skaneateles lake, N Y.
J. W. Hall & G. B. Simpson, coll. 1872

6265 $\frac{3884}{6}$ HYPOTYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 20, fig. 7.
Hamilton beds Skaneateles lake, N. Y.
W. M. Gebhard, coll. 1857

**Zaphrentis simplex** Hall

6266 $\frac{3887}{2}$ TYPE Hall. Illustrations of Devonian fossils. 1876. Corals, pl. 21, fig. 5.
Hamilton beds Moscow, Livingston co. N. Y.
C. Van Deloo, coll. 1865

6267 $\frac{3887}{3}$ TYPE Hall. Illustrations of Devonian fossils. 1876. pl. 21, fig. 11.
Hamilton beds Moscow, N. Y.
C. A. White & C. Van Deloo, coll. 1861

## VERMES

### TENTACULITES Schlotheim

**Tentaculites eldredgianus** Hartt & Rathbun

6268 $\frac{5289}{1}$ HYPOPLASTOTYPE Tentaculites eldredgianus Hartt & Rathbun. Annals of the New York lyceum of natural history. 1875. .11: 126.
Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 4, fig. 29.
Devonic (Ereré group) Ereré, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Tentaculites stübeli** Clarke

6269 $\frac{5290}{1}$ PLASTOTYPE Tentaculites stübeli Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 43, pl. 4, fig. 24.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6270 $\frac{5290}{2}$ PLASTOTYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 4, fig. 25, 26.
Devonic (Maecurú group)

Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6271 $\frac{5290}{3}$ **TYPE** Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 4 fig. 27.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6272 $\frac{5290}{4}$ **TYPE** Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 4, fig. 28.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Tentaculites trombetensis** Clarke

6273 $\frac{5291}{1}$ **PLASTOTYPE** Tentaculites trombetensis Clarke. Arch. do Mus. Nac. Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 19, pl. 2, fig. 26.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6274 $\frac{5291}{2}$ **TYPE** Clarke. Arch. do Mus. Nac. Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 2, fig. 27.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

On slab with type of Lingulops derbyi Clarke, pl. 1, fig. 4.

## BRACHIOPODA

### ANABAIA Clarke

**Anabaia paraia** Clarke

6275 $\frac{7071}{1}$ **TYPE** Anabaia paraia Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 12, pl. 2, fig. 2–4.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6276 $\frac{7071}{2}$ **TYPE** Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 2, fig. 5.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6277 $\frac{7071}{3}$ **PLASTOTYPE** Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 2, fig. 6

Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6278 $\frac{7071}{4}$ **PLASTOTYPE** Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 2, fig. 7.

Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6279 $\frac{7071}{5}$ **TYPE: PLASTOTYPE** Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 2, fig. 8.

Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6280 $\frac{7071}{6}$ **TYPE: PLASTOTYPE** Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 2, fig. 9.

Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

### CHONETES Fischer

**Chonetes** *cf.* **nova-scotica** Hall

6281 $\frac{7257}{1}$ **HYPOTYPE** Chonetes nova-scotica Hall. Canadian naturalist and geologist. 1860. 5: 144.

Chonetes cf. nova-scotica Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 1, fig. 25.

Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

### LINGULA Bruguiere

Lingula cuneata *see* Lingula *cf.* oblata

**Lingula** *cf.* **oblata** Hall

6282 $\frac{7693}{1}$ **HYPOTYPE** Lingula oblata Hall. Geology of New York; report on the 4th District. 1843. p. 77.

Lingula cuneata Derby. Arch. do Mus. Nac. do Rio de Janeiro. 1879. 2: 92.

Lingula cuneata Derby. Proceedings of the American philosophical society. 1879. 18: 168.

Lingula cf. oblata Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 4, pl. 1, fig. 3.

Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

LINGULOPS Hall

**Lingulops derbyi** Clarke

6283 $\frac{7723}{1}$ TYPE: PLASTOTYPE Lingulops derbyi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 5, pl. 1, fig. 4.

Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

On slab with type of Tentaculites trombetensis Clarke, pl. 2, fig. 27.

ORBICULOIDEA d'Orbigny

**Orbiculoidea hartti** Clarke

6284 $\frac{7897}{1}$ TYPE Orbiculoidea hartti Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 7, pl. 1, fig. 5, 6.

Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

ORTHIS Dalman

**Orthis callactis** Dalman *var.* **amazonica** Clarke

6285 $\frac{7924}{1}$ TYPE Orthis callactis var. amazonica Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 9, pl. 1, fig. 17.

Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6286 $\frac{7924}{2}$ TYPE: PLASTOTYPE Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 1, fig. 18, 19.

Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6287 $\frac{7924}{3}$ PLASTOTYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 1, fig. 20.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6288 $\frac{7924}{4}$ TYPE: PLASTOTYPE Clarke. Arch do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 1, fig. 21.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Orthis freitana** Clarke

6289 $\frac{7925}{1}$ TYPE Orthis freitana Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 10, pl. 1, fig. 22.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6290 $\frac{7925}{2}$ TYPE: PLASTOTYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 1, fig. 23, 24.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Orthis smithi** Clarke

6291 $\frac{7926}{1}$ TYPE Orthis smithi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 11, pl. 1, fig. 12.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6292 $\frac{7926}{2}$ TYPE: PLASTOTYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 1, fig. 13, 14.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6293 $\frac{7926}{3}$ TYPE: PLASTOTYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 1, fig. 15.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6294 $\frac{7926}{4}$ TYPE: PLASTOTYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 1, fig. 16.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

PHOLIDOPS Hall

**Pholidops trombetana** Clarke

6295 $\frac{8019}{1}$ TYPE Pholidops trombetana Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 8, pl. 1, fig. 11.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6296 $\frac{8019}{2}$ PLASTOTYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 1, fig. 7–9.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

## LAMELLIBRANCHIATA

ACTINOPTERIA Hall

**Actinopteria eschwegii** Clarke

6297 $\frac{9021}{1}$ TYPE Actinopteria eschwegii Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 45, pl. 5, fig. 1.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6298 $\frac{9021}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 5, fig. 2.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6299 $\frac{9021}{3}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 5, fig. 4.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6300 $\frac{9021}{4}$ **TYPE** Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 5, fig. 6.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby &. J M. Clarke, donors

6301 $\frac{9021}{5}$ **TYPE** Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 5, fig. 9.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Actinopteria humboldti** Clarke

6302 $\frac{9022}{1}$ **TYPE** Actinopteria humboldti Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 47, pl. 5, fig. 3.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6303 $\frac{9022}{2}$ **TYPE** Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 5, fig. 7.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6304 $\frac{9022}{3}$ **TYPE** Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 5, fig. 11.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6305 $\frac{9022}{4}$ **TYPE** Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 5, fig. 12.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**ANODONTOPSIS** McCoy

**Anodontopsis austrina** Clarke

6306 $\frac{9043}{1}$ **TYPE** Anodontopsis austrina Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 16, pl. 2, fig. 12.

Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Anodontopsis putilla** Clarke

6307 $\frac{9044}{1}$ TYPE Anodontopsis putilla Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 16, pl. 2, fig. 10, 11.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

CIMITARIA Hall

**Cimitaria** sp. Clarke

6308 $\frac{9104}{1}$ HYPOTYPE Cimitaria sp. Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 62, pl. 7, fig. 14.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Cimitaria karsteni** Clarke

6309 $\frac{9105}{1}$ TYPE Cimitaria karsteni Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 60, pl. 8, fig. 18.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6310 $\frac{9105}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 8, fig. 19.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

CLIDOPHORUS Hall

**Clidophorus brasilianus** Clarke

6311 $\frac{9111}{1}$ TYPE Clidophorus brasilianus Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 18, pl. 2, fig. 17, 18.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6312 $\frac{9111}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 2, fig. 19.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

CYPRICARDELLA Hall

**Cypricardella hartti** Clarke

6313 $\frac{9155}{1}$ TYPE Cypricardella hartti Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 63, pl. 7, fig. 1.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6314 $\frac{9155}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 7, fig. 2.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6315 $\frac{9155}{3}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 7, fig. 3.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Cypricardella pohli** Clarke

6316 $\frac{9156}{1}$ TYPE Cypricardella pohli Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 64, pl. 6, fig. 10.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

EDMONDIA de Koninck

Edmondia pondiana *see* Palaeoneilo pondiana

**Edmondia sylvana** Hartt & Rathbun

6317 $\frac{9196}{1}$ HYPOTYPE Edmondia sylvana Hartt & Rathbun. Annals of the New York lyceum of natural history. 1875. 11: 122.

Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 7, fig. 12.
Devonic (Ereré group) Ereré, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

GONIOPHORA Phillips

**Goniophora woodwardi** Clarke

6318 $\frac{9\,2\,6\,1}{1}$ TYPE Goniophora woodwardi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 53, pl. 6, fig. 3.
Devonic (Ereré group) Ereré, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

GRAMMYSIA de Verneuil

**Grammysia burmeisteri** Clarke

6319 $\frac{9\,2\,8\,3^a}{1}$ TYPE Grammysia burmeisteri Clarke. Arch. do. Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 65, pl. 7, fig. 9.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Grammysia gardneri** Clarke

6320 $\frac{9\,2\,9\,0^a}{1}$ TYPE Grammysia gardneri Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 67, pl. 7, fig. 10.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Grammysia lundi** Clarke.

6321 $\frac{9\,2\,9\,1^a}{1}$ TYPE Grammysia lundi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1889. v. 10. Author's Eng. ed. 1900. p. 66, pl. 6, fig. 11, 12.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6322 $\frac{9\,2\,9\,1^a}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1889. v. 10. Author's Eng. ed. 1900. pl. 6, fig. 13.
Devonic (Maecurú group)

Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Grammysia pissisi** Clarke

6323 $\frac{9295a}{1}$ TYPE Grammysia pissisi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 65, pl. 7, fig. 7.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6324 $\frac{9295a}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 7, fig. 8.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Grammysia ulrichi** Clarke

6325 $\frac{9298a}{1}$ TYPE Grammysia ulrichi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 67, pl. 7, fig. 12.
Devonic (Ereré group) Ereré, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Guerangeria** Oehlert or **Nyassa** Hall

**Guerangeria** (or **Nyassa**) **ortoni** Clarke

6326 $\frac{9299a}{1}$ TYPE Guerangeria (or Nyassa) ortoni Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 62, pl. 7, fig. 6.
Devonic (Ereré group) Ereré, Pará, Brazil
O. A. Derby & J. M. Clarke donors

LIOPTERIA Hall

**Liopteria browni** Clarke

6327 $\frac{9383}{1}$ TYPE Liopteria browni Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 48, pl. 5, fig. 13.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

MODIOMORPHA Hall

**Modiomorpha helmreicheni** Clarke

6328 $\frac{9532}{1}$ TYPE Modiomorpha helmreicheni Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 50, pl. 6, fig. 1.
Devonic (Maecurú group) Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6329 $\frac{9532}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 6, fig. 2.
Devonic (Maecurú group) Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6330 $\frac{9532}{3}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 6, fig. 17.
Devonic (Maecurú group) Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Modiomorpha pimentana** Hartt & Rathbun

6331 $\frac{9533}{1}$ HYPOTYPE Modiomorpha pimentana Hartt & Rathbun. Annals of New York lyceum of natural history. 1875. 11:123
Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 6, fig. 4.
Devonic (Ereré group) Ereré, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Modiomorpha sellowi** Clarke

6332 $\frac{9534}{1}$ TYPE Modiomorpha sellowi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 51, pl. 6, fig. 14.
Devonic (Maecurú group) Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6333 $\frac{9534}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 6, fig. 16.
Devonic (Maecurú group) Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6334 $\frac{9534}{3}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 6, fig. 15.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

NUCULA Lamarck

**Nucula bellistriata** Conrad *var.* **parvula** Clarke

6335 $\frac{9570a}{1}$ TYPE Nucula bellistriata var. parvula Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 70, pl. 8, fig. 10.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

NUCULITES Conrad

**Nuculites branneri** Clarke

6336 $\frac{9586}{1}$ TYPE Nuculites branneri Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 73, pl. 8, fig. 6.
Devonic (Ereré group) Ereré, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6337 $\frac{9586}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 8, fig. 7.
Devonic (Ereré group) Ereré, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6338 $\frac{9586}{3}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 8, fig. 8.
Devonic (Ereré group) Ereré, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Nuculites ererensis** Hartt & Rathbun

6339 $\frac{9587}{1}$ HYPOTYPE Nuculites ererensis Hartt & Rathbun. Annals of the New York lyceum of natural history. 1875. 11: 120.
Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 8, fig. 3.
Devonic (Ereré group) Ereré, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6340 $\frac{9587}{2}$ HYPOTYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 8, fig. 4.

Devonic (Ereré group) Ereré, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

**Nuculites smithi** Clarke

6341 $\frac{9588}{1}$ TYPE Nuculites smithi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 71, pl. 8, fig. 5.

Devonic (Maecurú group)

Rio Maecurú, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

PALAEONEILO Hall

**Palaeoneilo orbignyi** Clarke

6342 $\frac{9649b}{1}$ TYPE Palaeoneilo orbignyi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 74, pl. 8, fig. 14.

Devonic (Maecurú group)

Rio Maecurú, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

6343 $\frac{9649b}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 8, fig. 15.

Devonic (Maecurú group)

Rio Maecurú, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

6344 $\frac{9649b}{3}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 8, fig. 16.

Devonic (Maecurú group)

Rio Maecurú, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

6345 $\frac{9649b}{4}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 8, fig. 17.

Devonic (Maecurú group)

Rio Maecurú, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

**Palaeoneilo pondiana** Hartt & Rathbun (sp.)

6346 $\frac{9649c}{1}$ HYPOTYPE Edmondia pondiana Hartt & Rathbun. Annals of the New York lyceum of natural history. 1875. 11: 121.

Palaeoneilo pondiana Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 76, pl. 7, fig. 4.

Devonic (Ereré group) Ereré, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

**Palaeoneilo sulcata** Hartt & Rathbun

6347 $\frac{9649d}{1}$ HYPOTYPE Palaeoneilo sulcata Hartt & Rathbun. Annals of the New York lyceum of natural history. 1875. 11: 124.

Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 8, fig. 13.

Devonic (Ereré group) Ereré, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

SPHENOTUS Hall

**Sphenotus bodenbenderi** Clarke

6348 $\frac{9868}{1}$ TYPE Sphenotus bodenbenderi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 58, pl. 5, fig. 17.

Devonic (Maecurú group)

Rio Maecurú, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

6349 $\frac{9868}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 8, fig. 25.

Devonic (Maecurú group)

Rio Maecurú, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

6350 $\frac{9868}{3}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 8, fig. 26.

Devonic (Maecurú group)

Rio Maecurú, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

**Sphenotus gorceixi** Clarke

6351 $\frac{9869}{1}$ TYPE Sphenotus gorceixi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 59, pl. 5, fig. 14.
Devonic (Ereré group) Ereré, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6352 $\frac{9869}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 5, fig. 16.
Devonic (Ereré group) Ereré, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

TELLINOMYA Hall

**Tellinomya pulchella** Clarke

6353 $\frac{9906}{1}$ TYPE Tellinomya pulchella Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 17, pl. 2, fig. 13.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6354 $\frac{9906}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 2, fig. 14.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6355 $\frac{9906}{3}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 2, fig. 15.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J M. Clarke, donors

TOECHOMYA Clarke

**Toechomya freitasi** Clarke

6356 $\frac{9950}{1}$ TYPE Toechomya freitasi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 58, pl. 8, fig. 21.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J M. Clarke, donors

6357 $\frac{9950}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 8, fig. 22.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Toechomya rathbuni** Clarke

6358 $\frac{9951}{1}$ TYPE Toechomya rathbuni Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 57, pl. 8, fig. 23.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6359 $\frac{9951}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 8, fig. 24.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

## GASTROPODA

BELLEROPHON Montfort

**Bellerophon morganianus** Hartt & Rathbun

6360 $\frac{10020}{1}$ HYPOTYPE Bellerophon morganianus Hartt & Rathbun. Annals of the New York lyceum of natural history. 1875. 11: 117
Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 3, fig. 1–3.
Devonic (Ereré group) Ereré, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Bellerophon steltzneri** Clarke

6361 $\frac{10021}{1}$ PLASTOTYPE Bellerophon steltzneri Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 34, pl. 3, fig. 5, 6.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

BUCANIA Hall

**Bucania freitasi** Clarke

6362 $\frac{10032a}{1}$ TYPE Bucania freitasi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 35, pl. 3, fig. 22.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

Bucania trilobita *see* Bucaniella trilobita *var.* vira-mundo

BUCANIELLA Meek

**Bucaniella reissi** Clarke

6363 $\frac{10032aa}{1}$ TYPE Bucaniella reissi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 37, pl. 3, fig. 7–9.

Devonic (Maecurú group)

Rio Maecurú, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

**Bucaniella trilobita** Conrad *var.* **vira-mundo** Clarke

6364 $\frac{10032a^{2}}{1}$ TYPE Bucania trilobita Derby. Arch. do Mus. Nac. do Rio de Janeiro. 1879. 2: 92.

Bucania trilobita Derby. Proc. Amer. Phil. Soc. 1879. 28: 168.

Bucaniella trilobita var. vira-mundo. Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 18, pl. 2, fig. 20–22.

Siluric Rio Trombetas, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

DIAPHOROSTOMA Fischer

**Diaphorostoma ? agassizi** Clarke

6365 $\frac{10117}{1}$ TYPE: PLASTOTYPE Diaphorostoma ? agassizi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 32, pl. 4, fig. 20, 21.

Devonic (Maecurú group)

Rio Maecurú, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

**Diaphorostoma darwini** Clarke

6366 $\frac{10118}{1}$ TYPE Diaphorostoma darwini Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 32, pl. 4, fig. 18.

Devonic (Maecurú group) Rio Curuá, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

**Diaphorostoma furmanianum** Hartt & Rathbun (sp.)

6367 $\frac{10}{1}\frac{1}{1}\frac{1}{9}$ HYPOPLASTOTYPE Holopea furmanianum Hartt & Rathbun. Annals of the New York lyceum of natural history. 1875. 11: 115.

Diaphorostoma furmanianum Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 32, pl. 4, fig. 10.

Devonic (Maecurú group)

Rio Maecurú, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

Holopea furmanianum *see* Diaphorostoma furmanianum

PLATYCERAS Conrad

**Platyceras hartti** Clarke

6368 $\frac{10}{1}\frac{3}{1}\frac{2}{1}\frac{9}{1}$ TYPE Platyceras hartti Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 30, pl. 4, fig. 22, 23.

Devonic (Maecurú group)

Rio Maecurú, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

**Platyceras hussaki** Clarke

6369 $\frac{10}{1}\frac{3}{1}\frac{3}{1}\frac{0}{1}$ TYPE Platyceras hussaki Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 29, pl. 4, fig. 6.

Devonic (Maecurú group)

Rio Maecurú, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

6370 $\frac{10}{2}\frac{3}{2}\frac{3}{2}\frac{0}{2}$ HYPOTYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 4, fig. 7.

Devonic (Maecurú group)

Rio Maecurú, Pará, Brazil

O. A. Derby & J. M. Clarke, donors

**Platyceras steinmanni** Clarke

6371 $\frac{10331}{1}$ TYPE Platyceras steinmanni Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 30, pl. 4, fig. 8, 9.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Platyceras symmetricum** Hall *var.* **maecuruense** Clarke

6372 $\frac{10332}{1}$ TYPE Platyceras symmetricum var. maecuruense Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 31, pl. 4, fig. 1, 2.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Platyceras whitii** Clarke

6373 $\frac{10333}{1}$ TYPE Platyceras whitii Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 28, pl. 4, fig. 3, 4.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Platyceras whitii** Clarke *var.* **curua** Clarke

6374 $\frac{10334}{1}$ TYPE Platyceras whitii var. curuá Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 29, pl. 4. fig. 5.
Devonic (Maecurú group)
Rio Curuá, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

PLECTONOTUS Clarke

**Plectonotus derbyi** Clarke

6375 $\frac{10335}{1}$ TYPE Plectonotus derbyi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 38, pl. 3, fig. 14–16.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6376 $\frac{10335}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 3, fig. 17, 18.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

**Plectonotus ? salteri** Clarke

6377 $\frac{10336}{1}$ TYPE Plectonotus ? salteri Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 38, pl. 3 fig. 12, 13.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

PLEUROTOMARIA Defrance

**Pleurotomaria rochana** Hartt & Rathbun

6378 $\frac{10409}{1}$ HYPOPLASTOTYPE Pleurotomaria rochana Hartt & Rathbun. Annals of the New York lyceum of natural history. 1875. 11: 114.
Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 4, fig. 17.
Devonic (Ereré group) Ereré, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

PTOMATIS Clarke

**Ptomatis forbesi** Clarke

6379 $\frac{10437}{1}$ TYPE: PLASTOTYPE Ptomatis forbesi Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 42, pl. 3, fig. 23–25.
Devonic (Maecurú group)
Rio Maecurú, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

## PTEROPODA

CONULARIA Miller

**Conularia amazonica** Clarke

6380 $\frac{11011}{1}$ TYPE (original & counterpart): PLASTOTYPE Conularia amazonica Clarke. Arch. do Mus. Nac. do

Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 20, pl. 2, fig. 23, 25.

Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

6381 $\frac{11011}{2}$ TYPE Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 2, fig. 24.

Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

## CEPHALOPODA

### BALTOCERAS Holm

**Baltoceras (?) pusillum** Ruedemann

6382 $\frac{12035}{1}$ TYPE Baltoceras (?) pusillum Ruedemann. New York state museum bulletin 90. 1906. p. 431, pl. 9, fig. 4, 5.

Beekmantown (Fort Cassin beds)
Valcour, Clinton co. N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

### BARRANDEOCERAS Hyatt

**Barrandeoceras natator** Billings (sp.)

6383 $\frac{12050}{1}$ HYPOTYPE Nautilus natator Billings. Canadian naturalist. 1859. v. 4, no. 6, p. 466. Barrandeoceras natator Ruedemann. New York state museum bulletin 90. 1906. pl. 32, 33.

Upper Chazy limestone Valcour island, N. Y.
R. Ruedemann, coll. 1904

### CAMEROCERAS Conrad

**Cameroceras (Proterocameroceras) brainerdi** Whitfield (sp.)

6384 $\frac{12084}{13}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 1, fig. 5, 6.

Beekmantown (Fort Cassin beds)
Valcour, Clinton co. N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

6385 $\frac{12084}{14}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 2, fig. 1.

Beekmantown (Fort Cassin beds) Valcour, N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

**Cameroceras tenuiseptum** Hall (sp.)

6386 $\frac{12085}{1}$ HYPOTYPE Orthoceras tenuiseptum Hall. Paleontology of New York. 1847. 1: 35.
Cameroceras tenuiseptum Ruedemann. New York state museum bulletin 90. 1906. pl. 3, fig. 2.
Upper Chazy limestone Chazy, Clinton co. N. Y.
R. Ruedemann, coll. 1903

6387 $\frac{12085}{2}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 6, fig. 2.
Upper Chazy limestone
Valcour island, Clinton co. N. Y.
R. Ruedemann, coll. 1903

CYRTACTINOCERAS Hyatt

**Cyrtactinoceras boycii** Whitfield (sp.)

6388 $\frac{12095}{1}$ HYPOTYPE Cyrtoceras boycii Whitfield. American museum of natural history bulletin 8. 1886. p. 326.
Cyrtactinoceras boycii Ruedemann. New York state museum bulletin 90. 1906. p. 490, fig. 45.
Upper Chazy limestone
Valcour island, Clinton co. N. Y.
G. H. Hudson, donor

6389 $\frac{12095}{2}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 35, fig. 2.
Upper Chazy limestone Chazy, Clinton co. N. Y.
R. Ruedemann, coll. 1903

6390 $\frac{12095}{3}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 35, fig. 3, 4.
Middle Chazy Chazy, N. Y.
R. Ruedemann, coll. 1903

**Cyrtactinoceras champlainense** Ruedemann

6391 $\frac{12096}{1}$ TYPE Cyrtactinoceras champlainense Ruedemann. New York state museum bulletin 90. 1906. p. 491; p. 491, fig. 48, 49; pl. 34, fig. 3.

Upper Chazy limestone Chazy, Clinton co. N. Y.
R. Ruedemann, coll. 1903

6392 $\frac{12\,0\,9\,9\,6}{2}$ TYPE Ruedemann. New York state museum bulletin 90. 1906. p. 491, fig. 50; pl. 36, fig. 1, 2.
Upper Chazy limestone Chazy, N. Y.
R. Ruedemann, coll. 1903

CYRTENDOCERAS Remélé

**Cyrtendoceras (?) priscum** Ruedemann

6393 $\frac{12\,0\,9\,9\,8}{1}$ TYPE Cyrtendoceras (?) priscum Ruedemann. New York state museum bulletin 90. 1906. p. 430, pl. 2, fig. 2.
Beekmantown beds
Beekmantown, Clinton co. N. Y.
R. Ruedemann, coll. 1903

6394 $\frac{12\,0\,9\,9\,8}{2}$ TYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 2, fig. 3.
Beekmantown beds Beekmantown, N.Y.
R. Ruedemann, coll. 1903

6395 $\frac{12\,0\,9\,9\,8}{3}$ TYPE: PLASTOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 2, fig. 4.
Beekmantown beds Beekmantown, N. Y.
R. Ruedemann, coll. 1903

6396 $\frac{12\,0\,9\,9\,8}{4}$ TYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 2, fig. 5.
Beekmantown beds Beekmantown, N. Y.
R. Ruedemann, coll. 1903

CYRTOCERAS Goldfuss

Cyrtoceras boycii *see* Cyrtactinoceras boycii

Cyrtoceras metula *see* Cyrtoceras (Gomphoceras) metula

**Cyrtoceras (Gomphoceras) metula** Hall

6397 $\frac{12\,1\,0\,8}{2}$ TYPE Hall. 15th Annual report of the New York state cabinet of natural history. 1862. pl. 9, fig. 7.
Hall. Illustrations of Devonian fossils. 1876. Cephalopoda. pl. 46, fig. 1, 2.

Hall. Paleontology of New York. 1879. v. 5, pt 2, pl. 47, fig. 1, 2.

Onondaga limestone Clarence Hollow, N Y.

(**Cyrtoceras**) **confertissimum** Whitfield

6398 $\frac{1\,2\,1\,1\,2}{1}$ HYPOTYPE Cyrtoceras confertissimum Whitfield. American museum of natural history bulletin 8. 1886. p. 327.

Ruedemann. New York state museum bulletin 90. 1906. pl. 38, fig. 1–4.

Beekmantown (Fort Cassin beds)

Valcour, Clinton co. N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

DELTOCERAS Hyatt

**Deltoceras vaningeni** Ruedemann

6399 $\frac{1\,2\,1\,3\,1}{1}$ TYPE Deltoceras vaningeni. Ruedemann. New York state museum bulletin 90. 1906. p. 480; p. 481, fig. 39; pl 25, 26.

Lower Chazy limestone Valcour, Clinton co. N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

6400 $\frac{1\,2\,1\,3\,1}{2}$ TYPE Ruedemann. New York state museum bulletin 90. 1906. p. 481, fig. 40; pl. 27.

Lower Chazy limestone Valcour, N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

6401 $\frac{1\,2\,1\,3\,1}{3}$ TYPE Ruedemann. New York state museum bulletin 90. 1906. p. 481, fig. 41; pl. 28.

Lower Chazy limestone Valcour, N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

ENDOCERAS Hall

**Endoceras (?) champlainense** Ruedemann

6402 $\frac{1\,2\,1\,3\,2}{1}$ TYPE: PLASTOTYPE Endoceras (?) champlainense Ruedemann. New York state museum bulletin 90. 1906. p. 418; p. 419, fig. 5.

Beekmantown beds

Beekmantown, Clinton co. N. Y.

R. Ruedemann, coll. 1903

6403 $\frac{12\frac{1}{2}32}{}$ TYPE: PLASTOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 1, fig. 1.
Beekmantown beds Beekmantown, N. Y.
R. Ruedemann, coll. 1903

6404 $\frac{12\frac{1}{3}32}{}$ TYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 1, fig. 2.
Beekmantown beds Beekmantown, N. Y.
R. Ruedemann, coll. 1903

6405 $\frac{12\frac{1}{4}32}{}$ TYPE: PLASTOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 1, fig. 3.
Beekmantown beds Beekmantown, N. Y.

6406 $\frac{12\frac{1}{5}32}{}$ TYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 1, fig. 4.
Beekmantown beds Beekmantown, N. Y.
R. Ruedemann, coll. 1903

**Endoceras hudsoni** Ruedemann

6407 $\frac{12\frac{1}{1}33}{}$ TYPE Endoceras hudsoni Ruedemann. New York state museum bulletin 90. 1906. p. 421; p. 422, fig. 6; pl. 7.
Upper Chazy limestone
Valcour island, Clinton co. N. Y.
G. H. Hudson, donor

**Endoceras magister** Ruedemann

6408 $\frac{12\frac{1}{1}34}{}$ TYPE Endoceras magister Ruedemann. New York state museum bulletin 90. 1906. p. 423; p. 423, fig. 7; pl. 8.
Lower Chazy limestone
Valcour, Clinton co. N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

EURYSTOMITES Schröder

**Eurystomites accelerans** Ruedemann

6409 $\frac{12\frac{1}{1}50}{}$ TYPE Eurystomites accelerans Ruedemann. New York state museum bulletin 90. 1906. p. 460; p. 460, fig. 23; pl. 18, fig. 2, 3.
Beekmantown (Fort Cassin beds)
Valcour, Clinton co. N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

**Eurystomites amplectens** Ruedemann

6410 $\frac{12}{1}\frac{151}{}$ TYPE Eurystomites amplectens Ruedemann. New York state museum bulletin 90. 1906. p. 461; p. 461, fig. 24; pl. 18, fig. 4–7.

Beekmantown (Fort Cassin beds)

Valcour, Clinton co. N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

**Eurystomites kelloggi** Whitfield (sp.)

6411 $\frac{12}{1}\frac{152}{}$ HYPOTYPE Nautilus kelloggi Whitfield. American museum of natural history bulletin 8. 1836. p. 328.

Eurystomites kelloggi Ruedemann. New York state museum bulletin 90. 1906. p. 456, fig. 21.

Beekmantown (Fort Cassin beds)

Valcour, Clinton co. N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

6412 $\frac{12}{2}\frac{152}{}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. p. 458, fig. 22.

Beekmantown (Fort Cassin beds) Valcour, N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

6413 $\frac{12}{3}\frac{152}{}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 17.

Beekmantown (Fort Cassin beds) Valcour, N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

6414 $\frac{12}{4}\frac{152}{}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 18, fig. 1.

Beekmantown (Fort Cassin beds) Valcour, N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

GEISONOCERAS Hyatt

**Geisonoceras shumardi** Billings (sp.)

6415 $\frac{12}{1}\frac{155}{}$ HYPOTYPE Orthoceras shumardi Billings. Canadian naturalist and geologist. 1859. 4: 460.

Geisonoceras shumardi Ruedemann New York state museum bulletin 90. 1906. pl. 12, fig 4.

Middle Chazy limestone Chazy, Clinton co. N. Y.

R. Ruedemann, coll. 1903

GONIOCERAS Hall

**Gonioceras chaziense** Ruedemann

6416 $\frac{12\frac{2}{1}10}{1}$ TYPE Goniceras chaziense Ruedemann. New York state museum bulletin 90. 1906. p. 494, pl. 36, fig. 3.

Middle Chazy limestone Chazy, Clinton co. N. Y.
R. Ruedemann, coll. 1903

6417 $\frac{12\frac{2}{2}10}{1}$ TYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 36, fig. 4.

Middle Chazy limestone Chazy, N. Y.
R. Ruedemann, coll. 1903

Lituites eatoni *see* Schroederoceras eatoni

Lituites eatoni *var.* cassinensis *see* Schroederoceras cassinense

Lituites seelyi *see* Tarphyceras seelyi

LOXOCERAS McCoy

**Loxoceras moniliforme** Hall (sp.)

6418 $\frac{12\frac{2}{1}70}{1}$ HYPOTYPE Orthoceras moniliforme Hall. Paleontology of New York. 1847. 1: 35.

Loxoceras moniliforme Ruedemann. New York state museum bulletin 90. 1906. pl. 34, fig. 7.

Upper Chazy limestone Chazy, Clinton co. N. Y.
R. Ruedemann, coll. 1903

6419 $\frac{12\frac{2}{2}70}{1}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 34, fig. 8.

Upper Chazy limestone Chazy, N. Y.
R. Ruedemann, coll. 1903

6420 $\frac{12\frac{2}{3}70}{1}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 34, fig. 9.

Middle Chazy limestone
Saranac river, Plattsburg, N. Y.
G. van Ingen, coll. 1901

NANNO Clarke

**Nanno noveboracum** Ruedemann

6421 $\frac{12\frac{3}{1}17}{1}$ TYPE Nanno noveboracum Ruedemann. New York state museum bulletin 90. 1906. p. 427, pl. 9. fig. 6, 7.

Upper Chazy limestone Chazy, Clinton co. N. Y.
R. Ruedemann, coll. 1903

Nautilus jason *see* Plectoceras jason

Nautilus kelloggi *see* Eurystomites kelloggi

Nautilus natator *see* Barrandeoceras natator

ONCOCERAS Hall

**Oncoceras pristinum** Ruedemann

6422 $\frac{12336}{1}$ TYPE Oncoceras pristinum Ruedemann. New York state museum bulletin 90. 1906. p. 503, pl. 34, fig. 1.

Upper Chazy limestone Chazy, Clinton co. N. Y.
R. Ruedemann, coll. 1903

6423 $\frac{12336}{2}$ TYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 34, fig. 2.

Upper Chazy limestone Chazy, N. Y.

OOCERAS Hyatt

**Ooceras (?) lativentrum** Ruedemann

6424 $\frac{12338}{1}$ TYPE Ooceras (?) lativentrum. Ruedemann. New York state museum bulletin 90. 1906. p. 497; p. 498, fig. 52.

Lower Chazy limestone Chazy, Clinton co. N. Y.
G. van Ingen, coll. 1902

ORTHOCERAS Breynius

**Orthoceras** sp.

6425 $\frac{12428}{1}$ HYPOTYPE Orthoceras sp. Clarke. Arch. do Mus. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 2, fig. 28, 29.

Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

Orthoceras clintoni *see* Spyroceras clintoni

Orthoceras cornu-oryx *see* Orygoceras cornu-oryx

Orthoceras furtivum *see* Protocycloceras ? *cf.* furtivum

Orthoceras lamarcki *see* Protocycloceras lamarcki

**Orthoceras lentum** Ruedemann

6426 $\frac{12429}{1}$ TYPE Orthoceras lentum Ruedemann. New York state museum bulletin 90. 1906. p. 433; p. 433, fig. 12; pl. 14, fig. 1, 2, 3.

Upper Chazy limestone Chazy, Clinton co. N. Y.
R. Ruedemann, coll. 1903

Orthoceras moniliforme *see* Loxoceras moniliforme

**Orthoceras modestum** Ruedemann

6427 $\frac{12430}{1}$ TYPE Orthoceras modestum Ruedemann. New York state museum bulletin 90. 1906. p. 436; p. 436, fig. 14.

Upper Chazy limestone Chazy, Clinton co. N. Y.
R. Ruedemann, coll. 1903

6428 $\frac{12430}{2}$ TYPE Ruedemann. New York state musuem bulletin 90. 1906. pl. 12, fig. 1.

Upper Chazy limestone Chazy, N. Y.
R. Ruedemann, coll. 1903

6429 $\frac{12430}{3}$ TYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 12, fig. 2.

Upper Chazy limestone Chazy, N. Y.
G. H. Hudson, donor

6430 $\frac{12430}{4}$ TYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 12, fig. 3.

Upper Chazy limestone
Valcour island, Clinton co. N. Y.
G. H. Hudson, donor

**Orthoceras progressum** Ruedemann

6431 $\frac{12431}{1}$ TYPE Orthoceras progressum Ruedemann. New York state museum bulletin 90. 1906. p. 434; p. 434, fig. 13; pl. 12, fig. 5, 6.

Upper Chazy limestone
Valcour island, Clinton co. N. Y.
G. H. Hudson, donor

Orthoceras schumardi *see* Geisonoceras shumardi

Orthoceras tenuiseptum *see* Cameroceras tenuiseptum

Orthoceras subarcuatum *see* Spyroceras clintoni

**Orthoceras (?) vagum** Ruedemann

6432 $\frac{12432}{1}$ TYPE Orthoceras (?) vagum Ruedemann. New York state museum bulletin 90. 1906. p. 435, pl. 9, fig. 9; pl. 13, fig. 1, 2.
Upper Chazy limestone Valcour island, N. Y.
G. H. Hudson, donor

ORYGOCERAS Ruedemann

**Orygoceras cornu-oryx** Whitfield (sp.)

6433 $\frac{12438}{1}$ HYPOTYPE Orthoceras cornu-oryx Whitfield. American museum of natural history bulletin 8. 1886. p. 320.
Orygoceras cornu-oryx Ruedemann. New York state museum bulletin 90. 1906. pl. 14, fig. 6.
Beekmantown (Fort Cassin beds)
Valcour, Clinton co. N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

PILOCERAS Salter

**Piloceras explanator** Whitfield (sp.)

6434 $\frac{12460}{5}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 10, 11.
Beekmantown (Fort Cassin beds)
Valcour, Clinton co. N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

PLECTOCERAS Hyatt

**Plectoceras jason** Billings (sp.)

6435 $\frac{12465}{1}$ HYPOTYPE Nautilus jason Billings. Canadian naturalist and geologist. 1859. 4: 464.

Plectoceras jason Ruedemann. New York state museum bulletin 90. 1906. p. 485, fig. 44.

Lower Chazy limestone

Valcour, Clinton co. N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

6436 $\frac{12465}{2}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. p. 484, fig. 43; pl. 24, fig. 1.

Lower Chazy limestone Valcour, N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

6437 $\frac{12465}{3}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 30.

Lower Chazy limestone Valcour, N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

6438 $\frac{12465}{4}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. p. 484, fig. 42; pl. 29, 31.

Lower Chazy limestone Valcour, N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

PROTOCYCLOCERAS Hyatt

**Protocycloceras ?** *cf.* **furtivum** Billings (sp.)

6439 $\frac{12466}{1}$ HYPOTYPE: HYPOPLASTOTYPE Orthoceras furtivum Billings. Geology of Canada; Paleozoic fossils. 1865. 1: 337.

Protocycloceras ? cf. furtivum Ruedemann. New York state museum bulletin 90. 1906. pl. 16, fig. 3.

Beekmantown beds

Beekmantown, Clinton co. N. Y.

R. Ruedemann coll. 1903

**Protocycloceras lamarcki** Billings (sp.)

6440 $\frac{12467}{1}$ HYPOTYPE Orthoceras lamarcki Billings. Canadian naturalist and geologist. 1859. 4: 362.

Protocycloceras lamarcki Ruedemann. New York state museum bulletin 90. 1906. p. 442, fig. 15.

Beekmantown limestone (Fort Cassin beds)
Valcour, Clinton co. N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

6441 $\frac{1\,2\,4\,6\,7}{2}$ HYPOTYPE: HYPOPLASTOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 15, fig. 1.
Beekmantown beds
Beekmantown, Clinton co. N. Y.
R. Ruedemann, coll. 1903

6442 $\frac{1\,2\,4\,6\,7}{3}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. p. 443, fig. 16; pl. 15, fig. 2, 3.
Beekmantown (Fort Cassin beds) Valcour, N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

6443 $\frac{1\,2\,4\,6\,7}{4}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 15, fig. 4.
Beekmantown (Fort Cassin beds) Valcour, N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

6444 $\frac{1\,2\,4\,6\,7}{5}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 15, fig. 5.
Beekmantown (Fort Cassin beds) Valcour, N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

6445 $\frac{1\,2\,4\,6\,7}{6}$ HYPOTYPE: HYPOPLASTOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 15, fig. 6.
Beekmantown beds
Beekmantown, Clinton co. N. Y.
R. Ruedemann, coll. 1903

6446 $\frac{1\,2\,4\,6\,7}{7}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 16, fig. 1, 2.
Beekmantown beds Beekmantown, N. Y.
R. Ruedemann, coll. 1903

SCHROEDEROCERAS Hyatt

**Schroederoceras cassinense** Whitfield (sp.)

6447 $\frac{1\,2\,5\,1\,0}{1}$ HYPOTYPE Lituites eatoni var. cassinensis Whitfield. American museum of natural history bulletin 8. 1886. p. 332.
Schroederoceras cassinense Ruedemann. New York state museum bulletin 90. 1906. p. 477, fig. 36.

Beekmantown (Fort Cassin beds)
Valcour, Clinton co. N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

6448 $\frac{12510}{2}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 20, fig. 1, 2.
Beekmantown (Fort Cassin beds) Valcour, N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

**Schroederoceras eatoni** Whitfield (sp.)

6449 $\frac{12511}{1}$ HYPOTYPE Lituites eatoni Whitfield. American museum of natural history bulletin 8. 1886. p. 331.
Schroederoceras eatoni Ruedemann. New York state museum bulletin 90. 1906. pl. 20, fig. 3.
Beekmantown (Fort Cassin beds) Valcour, N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

6450 $\frac{12511}{2}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 20, fig. 4.
Beekmantown (Fort Cassin beds) Valcour, N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

SPYROCERAS Hyatt

**Spyroceras clintoni** Miller (sp.)

6451 $\frac{12515}{1}$ HYPOTYPE Orthoceras subarcuatum Hall. Paleontology of New York. 1847. 1: 34.
Orthoceras clintoni Miller. American Paleozoic Fossils. 1877. p. 244.
Spyroceras clintoni Ruedemann. New York state museum bulletin 90. 1906. p. 447, fig. 18.
Lower Chazy limestone Valcour, Clinton co. N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

6452 $\frac{12515}{2}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 16, fig. 4.
Upper Chazy limestone Chazy, Clinton co. N. Y.
R. Ruedemann, coll. 1903

6453 $\frac{12515}{3}$ HYPOTYPE Ruedemann. New York state museum bulletin 90. 1906 pl. 16, fig. 5.

Middle Chazy limestone

Valcour island, Clinton co. N. Y.

R. Ruedemann, coll. 1903

6454 $\frac{12515}{4}$ **HYPOTYPE** Ruedemann. New York state museum bulletin 90. 1906. pl. 16, fig. 6.

Upper Chazy limestone Chazy, N. Y.

R. Ruedemann, coll. 1903

6455 $\frac{12515}{5}$ **HYPOTYPE** Ruedemann. New York state museum bulletin 90. 1906. pl. 16, fig. 7.

Upper Chazy limestone

Little Monty bay, Lake Champlain, N. Y.

TARPHYCERAS Hyatt

**Tarphyceras seelyi** Whitfield (sp.)

6456 $\frac{12517}{1}$ **HYPOTYPE** Lituites seelyi Whitfield. American museum of natural history bulletin 8. 1886. p. 330.

Tarphyceras seelyi Ruedemann. New York state museum bulletin 90. 1906. p. 466, fig. 25.

Beekmantown (Fort Cassin beds)

Valcour, Clinton co. N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

6457 $\frac{12517}{2}$ **HYPOTYPE** Ruedemann. New York state museum bulletin 90. 1906. p. 467, fig. 26.

Beekmantown (Fort Cassin beds) Valcour, N. Y

G. van Ingen & R. Ruedemann, coll. 1899

6458 $\frac{12517}{3}$ **HYPOTYPE** Ruedemann. New York state museum bulletin 90. 1906. pl. 19, fig. 1; pl. 24, fig. 3.

Beekmantown (Fort Cassin beds) Valcour, N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

6459 $\frac{12517}{4}$ **HYPOTYPE** Ruedemann. New York state museum bulletin 90. 1906. pl. 19, fig. 2.

Beekmantown (Fort Cassin beds) Valcour, N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

6460 $\frac{12517}{5}$ **HYPOTYPE** Ruedemann. New York state museum bulletin 90. 1906. pl. 20, fig. 5.

Beekmantown (Fort Cassin beds) Valcour, N. Y.

G. van Ingen & R. Ruedemann, coll. 1899

6461 $\frac{12517}{6}$ HYPOTYPE New York state museum bulletin 90. 1906 pl. 21.
Beekmantown (Fort Cassin beds) Valcour, N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

**Tarphyceras clarkei** Ruedemann

6462 $\frac{12518}{1}$ TYPE Tarphyceras clarkei Ruedemann. New York state museum bulletin 90. 1906. p. 470; p. 471, fig. 27–31, pl. 22.
Beekmantown (Fort Cassin beds)
Valcour, Clinton co. N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

VAGINOCERAS Hyatt

**Vaginoceras oppletum** Ruedemann

6463 $\frac{12601}{1}$ TYPE Vaginoceras oppletum Ruedemann. New York state museum bulletin 90. 1906. p. 413, pl. 4, fig. 2, 3.
Upper Chazy limestone Chazy, Clinton co. N. Y.
R. Ruedemann, coll. 1903

6464 $\frac{12601}{2}$ TYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 5, fig. 1
Lower Chazy limestone
Valcour, Clinton co. N. Y.
G. van Ingen & R. Ruedemann, coll. 1899

6465 $\frac{12601}{3}$ TYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 5, fig. 2–4.
Upper Chazy limestone Chazy, N. Y.
R. Ruedemann, coll. 1903

6466 $\frac{12601}{4}$ TYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 6, fig. 1.
Upper Chazy limestone
Valcour island, Clinton co. N. Y.
G. H. Hudson, donor

6467 $\frac{12601}{5}$ TYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 9, fig. 1.
Upper Chazy limestone Valcour island, N. Y.
G. H. Hudson, donor

6468 $\frac{12601}{6}$ TYPE Ruedemann. New York state museum bulletin 90. 1906. pl. 9, fig. 2, 3.
Upper Chazy limestone Valcour island, N. Y.
G. H. Hudson, donor

## CRUSTACEA

### BOLLIA Jones & Holl

**Bollia lata** Vanuxem (Conrad) *var.* **brasiliensis** Clarke

6469 $\frac{13102}{1}$ TYPE Bollia lata var. brasiliensis Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. p. 22; pl. 2, fig. 30, 31.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

Cypridina minuta *see* Primitia minuta

### LEPIDOCOLEUS Faber

**Lepidocoleus polypetalus** Clarke

6470 $\frac{13681}{1}$ TYPE Lepidocoleus polypetalus Clarke. American Geologist. 1896. 17: 142, pl. 17, fig. 7, 8.
Helderbergian Albany co. N. Y.
J. M. Clarke, donor

### PEPHRICARIS Clarke

**Pephricaris horripilata** Clarke

6471 $\frac{13860}{2}$ TYPE Clarke. 15th annual report of the New York state geologist. 1898. 1: 732, fig. 2.
Chemung beds Alfred, N. Y.
J. M. Clarke, donor

### PRIMITIA Jones

**Primitia minuta** Eichwald

6472 $\frac{13942}{1}$ HYPOTYPE Cypridina minuta Eichwald. 1854. v. 27, pt 1, p. 99.
Primitia minuta Clarke. Arch. do Mus. Nac. do Rio de Janeiro. 1899. v. 10. Author's Eng. ed. 1900. pl. 2, fig. 32.
Siluric Rio Trombetas, Pará, Brazil
O. A. Derby & J. M. Clarke, donors

# CLASSIFICATION OF TYPE SPECIMENS BY GEOLOGIC FORMATIONS

**References are to the serial marginal numbers at the left of each page.**

## LOWER SILURIC

### BEEKMANTOWN LIMESTONE

**Cephalopoda**

Baltoceras (?) pusillum, 6382
Cameroceras (Proterocameroceras) brainerdi, 6384, 6385
Cyrtendoceras (?) priscum, 6393–6396
(Cyrtoceras) confertissimum, 6398
Endoceras (?) champlainense, 6402–6406
Eurystomites accelerans, 6409
Eurystomites amplectens, 6410
Eurystomites kelloggi, 6411–6414
Orygoceras cornu-oryx, 6433
Piloceras explanator, 6434
Protocycloceras (?) *cf.* furtivum, 6439
Protocycloceras lamarcki, 6440–6446
Schroederoceras cassinense, 6447, 6448
Schroederoceras eatoni, 6449, 6450
Tarphyceras seelyi, 6456–6461
Tarphyceras clarkei, 6462

### LOWER CHAZY LIMESTONE

**Cephalopoda**

Deltoceras vaningeni, 6399–6401
Endoceras magister, 6408
Ooceras (?) lativentrum, 6424
Plectoceras jason, 6435–6438
Spyroceras clintoni, 6451
Vaginoceras oppletum, 6464

### MIDDLE CHAZY LIMESTONE

**Cephalopoda**

Cyrtactinoceras boycii, 6389
Geisonoceras shumardi, 6415
Geisonoceras chaziense, 6416, 6417
Loxoceras moniliforme, 6420?
Spyroceras clintoni, 6453

### UPPER CHAZY LIMESTONE

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Cyrtactinoceras boycii, 6388–6390
Cyrtactinoceras champlainense, 6391, 6392
Endoceras hudsoni, 6407
Loxoceras moniliforme, 6418, 6419
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Orthoceras lentum, 6426
Orthoceras modestum, 6427–6430
Orthoceras progressum, 6431
Orthoceras (?) vagum, 6432
Spyroceras clintoni, 6452, 6454, 6455
Vaginoceras oppletum, 6463, 6465–6468

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Chonetes *cf.* nova-scotica, 6281
Lingula *cf.* oblata, 6282
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Orbiculoidea hartti, 6284
Orthis callactis *var.* amazonica, 6285–6288
Orthis freitana, 6289, 6290
Orthis smithi, 6291–6294
Pholidops trombetana, 6295, 6296

### Lamellibranchiata

Anodontopsis austrina, 6306
Anodontopsis putilla, 6307
Clidophorus brasilianus, 6311, 6312
Tellinomya pulchella, 6353–6355

### Gastropoda

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### Pteropoda

Conularia amazonica, 6380, 6381

### Cephalopoda

Orthoceras sp. 6425

### Crustacea

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### HELDERBERGIAN

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Chaetetes tenuis, 6191
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Favosites epidermatus, 6217–6219
Favosites epidermatus *var.* corticosus, 6220, 6221
Favosites hemisphericus, 6228
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Favosites hemisphericus *var.* distortus, 6231
Favosites hemisphericus *var.* rectus, 6232, 6233
Favosites hemisphericus *var.* turbinatus 6234–6236
Favosites tuberosus, 6241, 6242
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Michelinia (Pleurodictyum) maxima, 6257

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Cyrtoceras (Gomphoceras) metula, 6397

## HAMILTON BEDS

### Cnidaria

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Chaetetes fruiticosus, 6181–6183
Chaetetes furcatus, 6184–6187
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Cystiphyllum conifollis, 6194
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Heliophyllum halli, 6246, 6247
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Cimitaria sp., 6308
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Cypricardella hartti, 6313–6315
Cypricardella pohli, 6316
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Grammysia gardneri, 6320
Grammysia lundi, 6321, 6322
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Bellerophon steltzneri, 6361
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Edmondia sylvana, 6317
Goniophora woodwardi, 6318
Grammysia ulrichi, 6325
Guerangeria (or Nyassa) ortoni, 6326
Modiomorpha pimentana, 6331
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*New York State Education Department*

## New York State Museum

JOHN M. CLARKE, Director

### PUBLICATIONS

Packages will be sent prepaid except when distance or weight renders the same impracticable. On 10 or more copies of any one publication 20% discount will be given. Editions printed are only large enough to meet special claims and probable sales. When the sale copies are exhausted, the price for the few reserve copies is advanced to that charged by second-hand booksellers, in order to limit their distribution to cases of special need. Such prices are inclosed in [ ]. All publications are in paper covers, unless binding is specified.

**Museum annual reports** 1847–date. *All in print to* 1892, 50*c a volume*, 75*c in cloth;* 1892–*date*, 75*c*, *cloth.*

These reports are made up of the reports of the Director, Geologist, Paleontologist, Botanist and Entomologist, and museum bulletins and memoirs, issued as advance sections of the reports.

**Director's annual reports** 1904–date.

These reports cover the reports of the State Geologist and of the State Paleontologist. Bound also with the museum reports of which they form a part.

Report for 1904. 138p. 20*c*. Report for 1905. 102p. 23pl. 30*c*. Report for 1906. 186p. 41pl. 35*c*.

**Geologist's annual reports** 1881–date. Rep'ts 1, 3–13, 17–date, O; 2, 14–16, Q.

In 1898 the paleontologic work of the State was made distinct from the geologic and was reported separately from 1899–1903. The two departments were reunited in 1904, and are now reported in the Director's report.

The annual reports of the original Natural History Survey, 1837–41, are out of print.

Reports 1–4, 1881–84, were published only in separate form. Of the 5th report 4 pages were reprinted in the 30th museum report, and a supplement to the 6th report was included in the 40th museum report. The 7th and subsequent reports are included in the 41st and following museum reports except that certain lithographic plates in the 11th report (1891) and 13th (1893) are omitted from the 45th and 47th museum reports.

Separate volumes of the following only are available.

| *Report* | *Price* | *Report* | *Price* | *Report* | *Price* |
|---|---|---|---|---|---|
| 12 (1892) | $.50 | 17 | $.75 | 21 | $.40 |
| 14 | .75 | 18 | .75 | 22 | .40 |
| 15, 2v. | 2 | 19 | .40 | 23 | .45 |
| 16 | 1 | 20 | .50 | [*See* Director's annual reports] | |

**Paleontologist's annual reports** 1899–date.

*See* first note under Geologist's annual reports.

Bound also with museum reports of which they form a part. Reports for 1899 and 1900 may be had for 20c each. Those for 1901–3 were issued as bulletins. In 1904 combined with the Director's report.

**Entomologist's annual reports** on the injurious and other insects of the State of New York 1882–date.

Reports 3–20 bound also with museum reports 40–46, 48–58 of which they form a part. Since 1898 these reports have been issued as bulletins. Reports 3–4, 17 are out of print, other reports with prices are:

| *Report* | *Price* | *Report* | *Price* | *Report* | *Price* |
|---|---|---|---|---|---|
| 1 | $.50 | 9 | $.25 | 15 (En 9) | $.15 |
| 2 | .30 | 10 | .35 | 16 ( " 10) | .25 |
| 5 | .25 | 11 | .25 | 18 ( " 17) | .20 |
| 6 | .15 | 12 | .25 | 19 ( " 21) | .15 |
| 7 | .20 | 13 | .10 | 20 ( " 24) | .40 |
| 8 | .25 | 14 (En 5) | .20 | 21 ( " 26) | .25 |

Reports 2, 8–12 may also be obtained bound separately in cloth at 25c in addition to the price given above.

**Botanist's annual reports** 1867–date.

Bound also with museum reports 21–date of which they form a part; the first Botanist's report appeared in the 21st museum report and is numbered 21. Reports 21–24, 29, 31–41 were not published separately.

Separate reports for 1871–74, 1876, 1888–96 and 1898 (Botany 3) are out of print. Report for 1897 may be had for 40c; 1899 for 20c; 1900 for 50c. Since 1901 these reports have been issued as bulletins [*see* Bo 5–9].

Descriptions and illustrations of edible, poisonous and unwholesome fungi of New York have also been published in volumes 1 and 3 of the 48th (1894) museum report and in volume 1 of the 49th (1895), 51st (1897), 52d (1898), 54th (1900), 55th (1901), 56th (1902), 57th (1903) and 58th (1904) reports. The descriptions and illustrations of edible and unwholesome species contained in the 49th, 51st and 52d reports have been revised and rearranged, and, combined with others more recently prepared, constitute Museum memoir 4.

**Museum bulletins** 1887–date. O. *To advance subscribers, $2 a year or $1 a year for division (1) geology, economic geology, paleontology, mineralogy; 50c each for divisions (2) general zoology, archeology and miscellaneous, (3) botany, (4) entomology.*

Bulletins are also found with the annual reports of the museum as follows:

| *Bulletin* | *Report* | *Bulletin* | *Report* | *Bulletin* | *Report* | *Bulletin* | *Report* |
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The figures in parenthesis in the following list indicate the bulletin's number as a New York State Museum bulletin.

**Geology. G1 (14)** Kemp, J. F. Geology of Moriah and Westport Townships, Essex Co. N. Y., with notes on the iron mines. 38p. 7pl. 2 maps. Sep. 1895. 10*c*.

**G2 (19)** Merrill, F. J. H. Guide to the Study of the Geological Collections of the New York State Museum. 162p. 119pl. map. Nov. 1898. [50*c*]

**G3 (21)** Kemp, J. F. Geology of the Lake Placid Region. 24p. 1pl. map. Sep. 1898. 5*c*.

**G4 (48)** Woodworth, J. B. Pleistocene Geology of Nassau County and Borough of Queens. 58p. il. 9pl. map. Dec. 1901. 25*c*.

**G5 (56)** Merrill, F. J. H. Description of the State Geologic Map of 1901. 42p. 2 maps, tab. Oct. 1902. 10*c*.

**G6 (77)** Cushing, H. P. Geology of the Vicinity of Little Falls, Herkimer Co. 98p. il. 15pl. 2 maps. Jan. 1905. 30*c*.

**G7 (83)** Woodworth, J. B. Pleistocene Geology of the Mooers Quadrangle. 62p. 25pl. map. June 1905. 25*c*.

**G8 (84)** —— Ancient Water Levels of the Champlain and Hudson Valleys. 206p. 11pl. 18 maps. July 1905. 45*c*.

**G9 (95)** Cushing, H. P. Geology of the Northern Adirondack Region. 188p. 15pl. 3 maps. Sep. 1905. 30*c*.

**G10 (96)** Ogilvie, I. H. Geology of the Paradox Lake Quadrangle. 54p. il. 17pl. map. Dec. 1905. 30*c*.

**G11 (106)** Fairchild, H. L. Glacial Waters in the Lake Erie Basin. 88p. 14pl. 9 maps. Feb. 1907. 35*c*.

Woodworth, J. B.; Hartnagel, C. A.; Whitlock, H. P.; Hudson, G. H.; Clarke, J. M.; White, David; Berkey, C. P. Geological Papers. *In press.*

*Contents:* Woodworth, J. B. Postglacial Faults of Eastern New York.
Hartnagel, C. A. Stratigraphic Relations of the Oneida Conglomerate.
—— Upper Siluric and Lower Devonic Formations of the Skunnemunk Mountain Region.
Whitlock, H. P. Minerals from Lyon Mountain, Clinton Co.
Hudson, G. H. On some Pelmatozoa from the Chazy Limestone of New York.
Clarke, J. M. Some New Devonic Fossils.
—— An Interesting Style of Sand-filled Vein.
—— Eurypterus Shales of the Shawangunk Mountains in Eastern New York.
White, David. A Remarkable Fossil Tree Trunk from the Middle Devonic of New York.
Berkey, C. P. Structural and Stratigraphic Features of the Basal Gneisses of the Highlands.

Fairchild, H. L. Drumlins of New York. *In press.*
—— Later Glacial Waters in Central New York. *Prepared.*
Cushing, H. P. Geology of the Theresa Quadrangle. *In preparation.*
—— Geology of the Long Lake Quadrangle. *In press.*
Berkey, C. P. Geology of the Highlands of the Hudson. *In preparation.*

**Economic geology. Eg1 (3)** Smock, J. C. Building Stone in the State of New York. 152p. Mar. 1888. *Out of print.*

**Eg2 (7)** —— First Report on the Iron Mines and Iron Ore Districts in the State of New York. 6+70p. map. June 1889. *Out of print.*

**Eg3 (10)** —— Building Stone in New York. 210p. map, tab. Sep. 1890. 40*c*.

**Eg4** (11) Merrill, F. J. H. Salt and Gypsum Industries of New York. 92p. 12pl. 2 maps, 11 tab. Ap. 1893. [50*c*]

**Eg5** (12) Ries, Heinrich. Clay Industries of New York. 174p. 2pl. map. Mar. 1895. 30*c*.

**Eg6** (15) Merrill, F. J. H. Mineral Resources of New York. 224p. 2 maps. Sep. 1895. [50*c*]

**Eg7** (17) —— Road Materials and Road Building in New York. 52p. 14pl. 2 maps. Oct. 1897. 15*c*.

**Eg8** (30) Orton, Edward. Petroleum and Natural Gas in New York. 136p. il. 3 maps. Nov. 1899. 15*c*.

**Eg9** (35) Ries, Heinrich. Clays of New York; their Properties and Uses. 456p. 140pl. map. June 1900. $1, *cloth*.

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